

H-60 Black Hawk in action



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Double Vision leads a flight of UH-60A Black Hawks of the 101st Airborne low over the Iraqi desert during the opening assault of the DESERT STORM ground war.

Acknowledgments:

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Dedication

This book is dedicated to all the brave men and women who fly and maintain the H-60, to all our Vietnam Veterans who gave so much for so little recognition and appreciation, to my wife and best friend Diane, to my sons Adam and Austin, to my nephew CW2 J. Bryan Creel and finally, in memory of my wonderful mom, Johnye Kate Pickett (1921-1991).

Credits:

Thanks to the following for sharing their photographs, knowledge and/or experience:

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SGT Robert Fairbanks
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WO1 Mike Oldfield
WO1 John Pruden
SGT Richard Berthold
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CW3 Roger Brown
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CW2 James H. Smith
Werner Roth

BATTLE CAT, a UH-60A Black Hawk assigned to the 101st Airborne Division (Air Assault), prepares to lift a 105mm howitzer during a training mission. The Black Hawk has the power to easily lift the gun, its crew and ammunition. (Stan Stacey)



INTRODUCTION

The H-60 family of military helicopters (Sikorsky designation S-70) evolved from the experiences learned in combat in Southeast Asia. The UH-1 Huey's prolific use led to true mobility and revealed the true value of the helicopter to a modern army. Many of the airmobility tactics used today were developed during this conflict.

In Vietnam the helicopter had become more than just an observation and aeromedical evacuation platform. It provided battlefield commanders with accurate, close-in air support, rapid troop transportation without the restrictions imposed by terrain, rapid resupply, airborne command and control, electronic jamming and support, special operations insertions and extractions, combat rescue of downed aviators behind enemy lines or at sea, recovery of downed aircraft and many other missions.

Even though the helicopters used in Vietnam performed superbly, there were problems. These aircraft did not have the power to carry full loads under "hot and high" conditions, which were common in this theater. Maintenance requirements were relatively high to keep the machines in the air and, despite the fact that many aircraft took multiple hits and kept flying, a single well placed 7.62mm round could bring down most Vietnam era helicopters.

Although the UH-1 Huey serves to this day with distinction, the Army needed an aircraft that would be more survivable on the modern battlefield and be capable of lifting a full squad of infantry under just about all weather conditions. With this in mind, the search began for a replacement for the UH-1 during 1966. Concept formulation studies began that year led to the UTTAS (Utility Tactical Transport Aircraft System) program during 1971.

The Army's basic UTTAS requirement consisted of the following: exploitation of the latest technology, fly before buy to prove concepts and technology, a thorough test program of the prototypes with a lengthy fly-off competition and once the tests were completed, selection of a winning design.

The Army's UTTAS program officially began in December of 1971 with a Request For Proposals (RFP) being issued to various companies. Responses to the RFPs were submitted by Sikorsky, Boeing Vertol and Bell Helicopter Company. These were closely analyzed by the Army and two contracts were awarded in August of 1972 for the construction of prototypes: one to Boeing Vertol (YUH-61) and one to Sikorsky (YUH-60). The Army planned to thoroughly test these prototype aircraft in a fly-off that would result in the eventual winner.

The prototype contracts called for three flight test units, one ground unit and one static test unit, although both Sikorsky and Boeing Vertol built a fourth flying prototype with their own funds to "enhance their own position." The prototypes each had to meet or exceed the demanding UTTAS requirements, which included the following hot and high performance criteria: at 4,000 feet and 95 degrees Fahrenheit, the aircraft must achieve a minimum vertical rate of climb of 450 FPM fully loaded, using no more than 95% of intermediate rated power.

Speed and endurance requirements called for the capability to fly at 145 knots minimum and have an endurance of at least 2.3 hours. To meet the maneuverability requirement, the prototype had to perform the "UTTAS maneuver" which consisted of the ability to clear a 200 foot vertical obstacle (within 1,100 feet horizontal) while pulling 1.75 Gs going over and .5 negative Gs once clear of the obstacle. This specification was to insure that the aircraft had the maneuverability to perform NOE (nap of the earth) flying, even under hot and high conditions.

The prototypes had to be able to impact vertically at forty-two feet per second with no fatalities to the crew or cabin occupants. Retention of high mass items such as the main rotor system, gearbox and engines were also specified as part of the prototype's crashworthiness requirement. These items could not penetrate the cabin or cockpit area.

The prototypes also had to meet an improved survivability requirement that specified a reduced infrared signature to protect against shoulder fired, heat seeking missiles. This specification also called for zero vulnerability to a single 7.62MM projectile. This was the first time this requirement had been placed on a helicopter and was accomplished in several ways. Critical systems were made redundant and separated so that one round could not disable them all. Armor plate was also used in certain areas (the pilots seats) to provide increased protection. The UTTAS specifications also required increased reliability and maintainability with greatly reduced maintenance man-hours per flight hour.

The aircraft also had to fit into a C-130, two into a C-141 and six in a C-5. The loading also had to be completed within a short period of time and with a minimum of manpower. This requirement had a significant effect on aircraft design. Since the main rotor head and blades would require too much time and manpower to remove, the original prototypes were built with a very low main rotor. This low main rotor appeared not only on the YUH-60s but on the Boeing Vertol YUH-61s and the Advanced Attack Helicopter prototype (Hughes YAH-64) as well.

The first flight of the Sikorsky YUH-60 (73-21650) took place on 17 October 1974, only twenty-seven months after the contract was issued and six weeks ahead of schedule. First flight of the Boeing Vertol YUH-61 took place in November and was also on schedule.

Boeing Vertol test pilots Frank Duke and Len Freisner lift off in the YUH-61 prototype during its first flight on 29 November 1974. The YUH-61 had a unique kneeling system for the main landing gear to enable ground crews to perform maintenance and inspection on the tail rotor without special work platforms. (Boeing Vertol via USAAM)



The YUH-60 flight test program revealed the need for some changes in the aircraft's configuration. The large fixed sweptback horizontal stabilizers were found to cause an excessive nose up attitude during a quick stop flare for landing. This was caused by main rotor downwash impinging on the stabilizer. After testing a number of alternative designs (1974 and into early 1975) a movable all flying stabilator was developed. The prototype, modified with this stabilator first flew on 13 March 1975. The stabilator was depressed 40 degrees in the hover and in low speed flight to reduce effects of the main rotor downwash.

The tail rotor pylon area was reduced in size to lessen the effect of the tail rotor downwash. The original vertical pylon had been intended to be large enough to counteract engine torque in forward flight if tail rotor thrust was lost. The modified prototype with the smaller tail rotor pylon first flew in October of 1975.

Another change was in the main rotor head. It was found that the rotor head had to be raised due to rotor vibration caused by the proximity of the rotors to the airframe which created stress loads on the airframe. As a result, the rotor shaft was raised fifteen inches by the installation of a main rotor shaft extension. This extension was removable so that the rotor head could be lowered (not removed) for loading onto a C-130 or C-141.

Other minor changes were made and on 17 May 1975, the production standard YUH-60 first made its first flight. On 19 March 1976 two final configuration prototypes were delivered to the Army at Fort Rucker, Alabama for developmental testing and one was delivered to Edwards Air Force Base, California, for engineering testing. The Fort Rucker machines were flown to Fort Campbell, Kentucky for operation testing in June of 1976 and, when the testing was completed, some 812 flight hours had been logged in all climates, from desert conditions to -65 degrees Fahrenheit.

The UTTAS competition ended on 23 December 1976 when the Army declared the Sikorsky YUH-60 as the winner. In September of 1977, the Army announced that the YUH-60 would be named the Black Hawk, following the Army tradition of naming its aircraft for Native American tribes.



The first flying YUH-60A prototype (73-21650) displays its large cargo cabin, designed to carry a full squad of soldiers and their equipment. The forward sliding crew chief/gunner window has been modified, with the original single piece window being replaced by a two piece sliding window. (Sikorsky via USAAM)

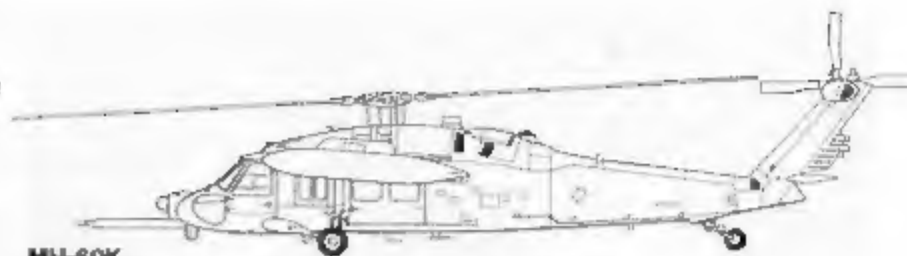
This YUH-60A prototype carries a flight data sensor boom on the starboard side. The boom provided important information during the initial flight test program. The aircraft featured swept horizontal stabilizers, a short rotor mast and a wide chord tail rotor pylon. (Sikorsky via USSAM)



Development



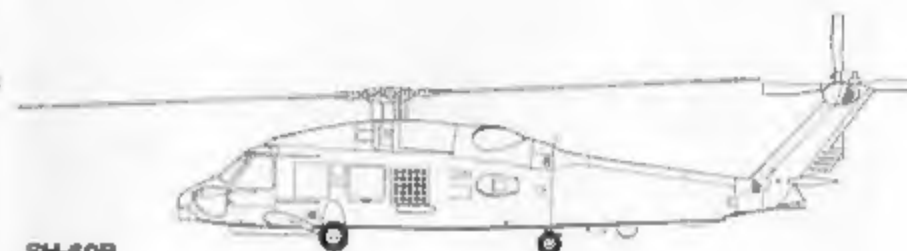
YUH-60



MH-60K



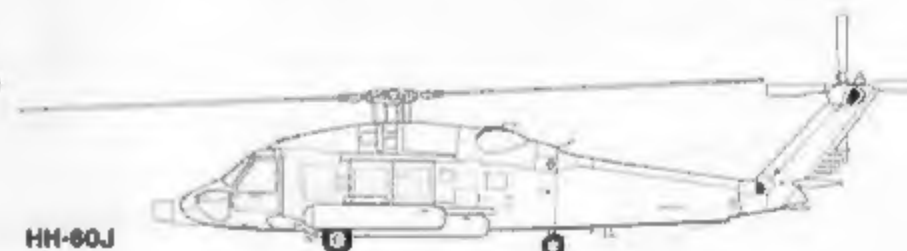
UH-60A



SH-60B



VH-60



HH-60J



UH-60L



MH-60G

UH-60A/MH-60A Black Hawk

The maiden flight of the first production UH-60A Black Hawk took place on 17 October 1978, exactly four years after the first flight of the YUH-60 prototype, and the aircraft was delivered to the Army two weeks later on 31 October. The production UH-60A is powered by two 1,543 shp General Electric T700-GE-700 turboshaft engines giving the aircraft a maximum cruising speed of 146 knots (never exceed airspeed is 193 knots) and a service ceiling of 19,300 feet. The maximum gross weight of the UH-60A is 20,250 pounds.

The production UH-60A differed from the early prototypes in a number of ways. The upper fuselage contours were reconfigured and the engine exhaust ports were enlarged. The two piece forward fuselage fairing on the prototypes had incorporated cooling air intakes, while the UH-60A had a single piece forward fairing that was reduced in size. The single piece large forward cabin window was replaced by a two piece window. The cockpit door windows were also changed from two panel windows to a larger single panel window. Finally, the early retractable tailwheel was replaced by a fixed tailwheel.

Over the course of UH-60A production, a number of improvements have been made to the basic troop transport to enhance its capabilities or as a result of changing mission requirements. The Army wanted the Black Hawk to be able to self deploy to Europe and had originally expected to use cabin-mounted fuel cells for this purpose. Since these internal mounted fuel cells reduce the aircraft's crashworthiness and severely limit internal cargo capacity, the Army requested that Sikorsky devise an external mounting for fuel tanks.

As a result of this requirement, the External Stores Support System (ESSS) was designed to allow the Black Hawk to carry the needed fuel tanks outside the cabin. The ESSS consists of a pair of graphite epoxy stub wings and external bracing struts. The stub wings are mounted high on the fuselage between the forward cabin windows and the main fuselage cargo door. The wings are stressed to carry two 230 gallon and two 450 gallon external fuel tanks which increases the Black Hawk's range to over 1,200 nautical miles. Besides fuel tanks, the ESSS can carry other stores (up to 10,000 pounds) including: Hellfire laser guided missiles (with target designation from ground or other airborne platforms), 20MM cannon pods, 2.75 inch FFAR (Folding Fin Aerial Rocket) pods and M56 mine dispensing pods.

The Army also decided to reduce the aircraft's infrared signature under all flight profiles. The first UH-60A infrared suppression system was known as the "IR Cruise Suppressor." This system required 80 knots of forward airspeed to be effective. Since the Army realized that their aircraft would spend a lot of time below 80 knots in Nap of the Earth (NOE) flight and in landing and hovering, they realized that a new system had to be devised. In early 1980, General Electric and Sikorsky Aircraft devised the Hover Infrared Suppressor Subsystem (HIRSS, pronounced HERZ). This system redirects engine exhaust and mixes cool air into the exhaust stream. It is effective in all flight profiles and became standard on all production UH-60s built after 1987. Eventually all Black Hawks will be retrofitted with this system.

Armament on early UH-60As consisted of a pair of 7.62MM M60D machine guns on swivel mounts in the forward cabin windows. Later aircraft have provisions for mounting M134 Miniguns in place of the M60s, greatly increasing the Black Hawk's firepower.

Other "product improvements" to the basic Black Hawk include the incorporation of a wire strike protection system with cable cutters on the top and bottom of the fuselage, installation of an accident data recorder, installation of a swing out rescue hoist on the starboard side of the cabin and installation of a winterization kit with main and tail rotor deicing.

The U.S. Customs Service acquired fourteen UH-60As for use in the war on drugs. These aircraft are standard early UH-60As that are equipped with a floodlight on the port side. Eleven UH-60As were also acquired by the U. S. Air Force for use as transition trainers for the HH-60A and HH-60D programs that were later canceled. These UH-60As have since been converted into MH-60G Pave Hawk configuration.

Deliveries of UH-60As to the Army ended, after delivery of some 974 aircraft, during late 1989 when the production line shifted over to the UH-60L.

MH-60A

The unique needs of special operations units led to a modification program under which thirty UH-60As were converted to the MH-60A special mission configuration. These aircraft were known as "Velcro Hawks" by Sikorsky due to the way systems are "stuck" on the aircraft after their delivery to the Army. MH-60As were usually equipped with a chin mounted Forward Looking Infrared (FLIR), a HIRSS or IR Cruise Suppressor, night vision equipment, additional radio/navigational equipment, chaff/flare dispensers and a Sanders IR jammer (called a Disco Light) on the upper fuselage. The

The crew chief and gunner of this UH-60A Black Hawk are in communication with the pilot via the aircraft's intercomm system. The cables from the crewmen's helmets are plugged into jacks inside the cabin. The UH-60A has quickly replaced the UH-1 as the Army's standard troop transport helicopter. (Luis Yarro)

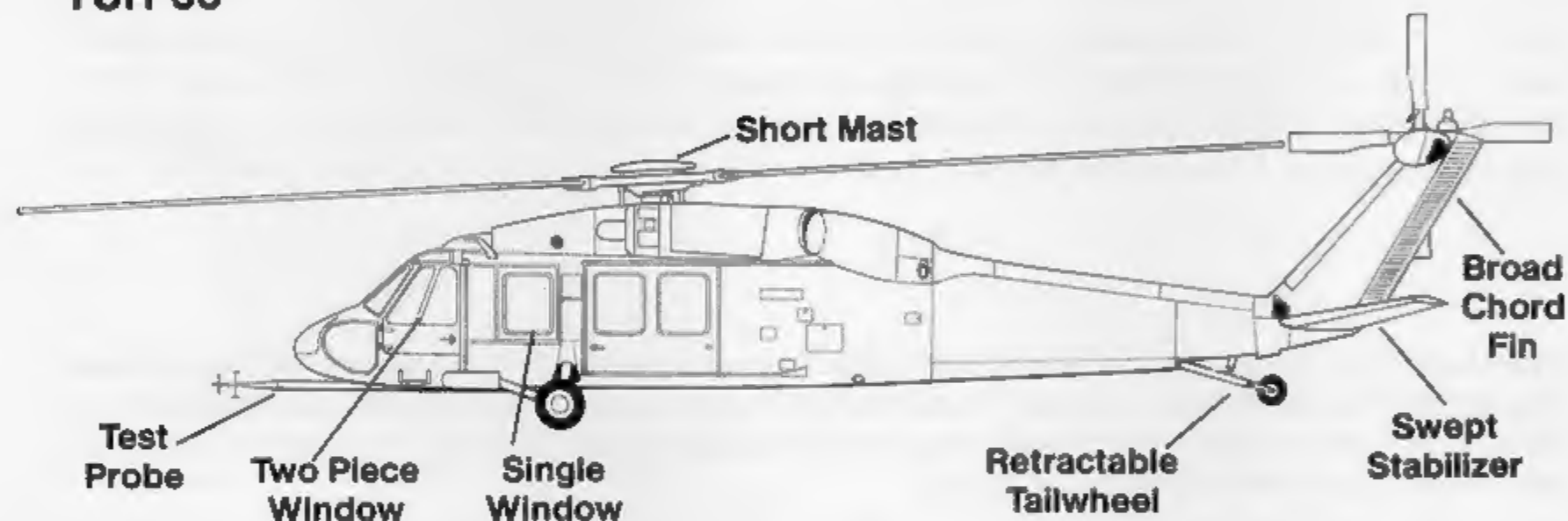


MH-60s are usually armed with M134 Miniguns as standard and carry a 117 gallon auxiliary fuel tank in the cabin.

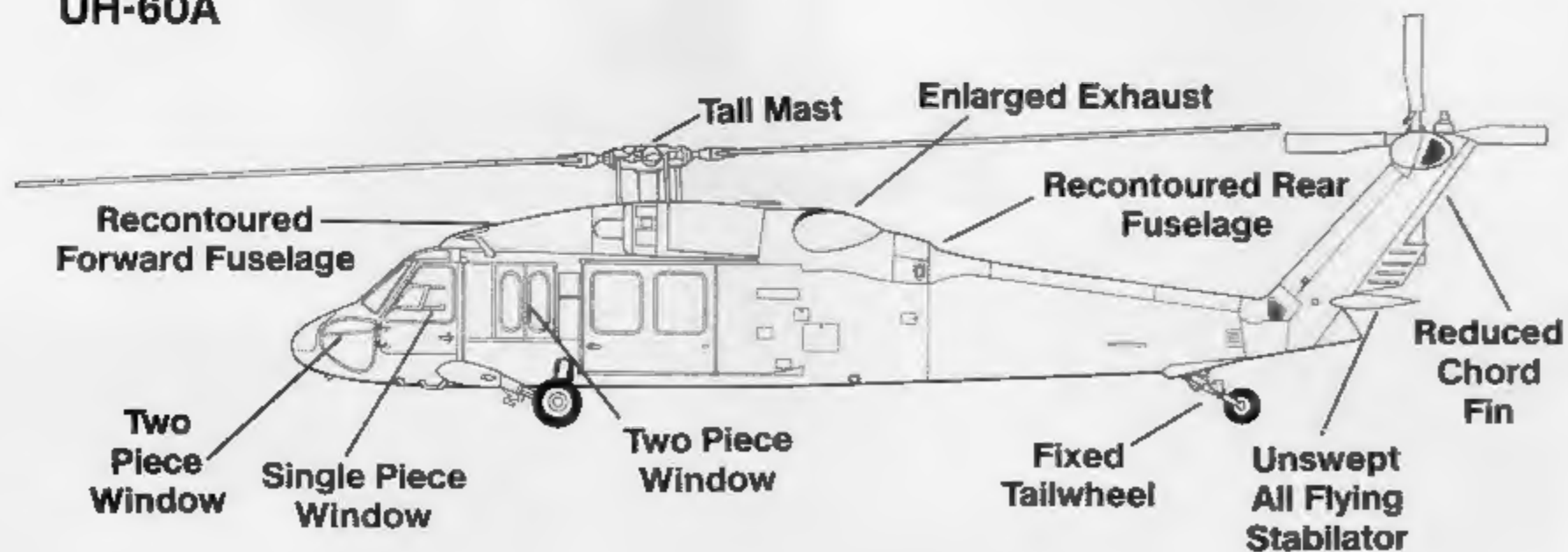
The "Velcro Hawks" were assigned to the 160th Special Operations Aviation Regiment at Fort Campbell, KY and the 3rd Battalion at Savannah Army Air Field, GA until replaced by MH-60K Pace Hawks. Some fifteen aircraft were then transferred to the Oklahoma Army National Guard at Tulsa.

Fuselage Development

YUH-60



UH-60A



The UH-60A Black Hawk is a robust aircraft with plenty of power to perform its mission under most conditions. This UH-60A has the higher rotor mast, single piece pilot's door window and revised upper fuselage contours introduced on production UH-60As. (Richard Berthold)

The UH-60A Black Hawk's main rotor head is a one piece titanium hub with elastomeric bearings to provide for blade flap, lead and lag. This system requires no lubrication and performed well in the sandy conditions of Saudi Arabia during the Gulf War. (Paul Pickett)





In combat, troop seats are usually removed to allow for faster egress and to provide more space for extra weapons and gear. This UH-60A of the 101st Airborne Division (Air Assault) has the standard exhaust and carries an ALQ-144 IR Jammer (Disco Light) on the upper fuselage. (Mike Oldfield via Dana Ravenberg)

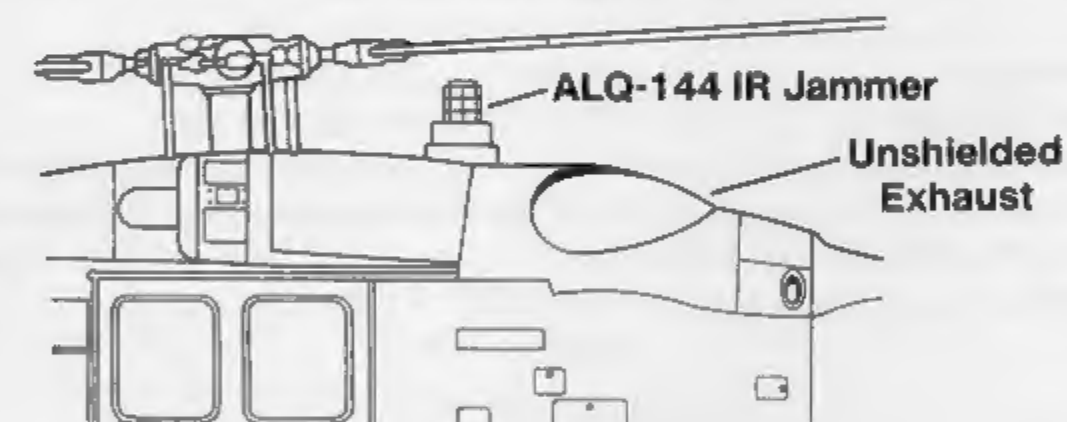
This UH-60A Black Hawk has the Cruise IR Suppressor system installed over the engine exhausts. This system only worked to suppress the engine's IR signature when the aircraft had a forward speed of at least eighty knots. (Thomas Gruenewald)



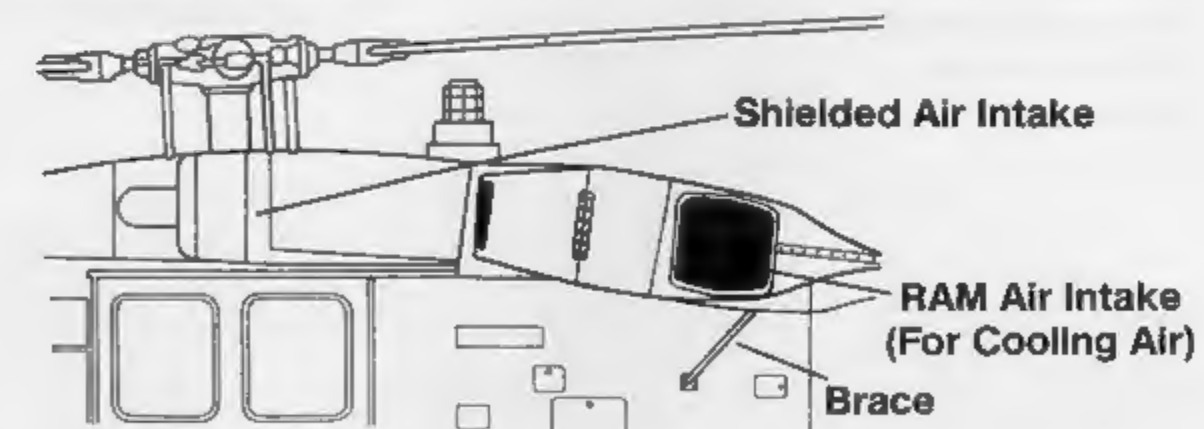
A UH-60A from the 3rd Armored Division cruises over one of the many beautiful small villages in Germany. This Black Hawk is equipped with the Hover Infrared Suppression System (HIRSS) which reduces engine IR signature in all flight profiles. (James H. Smith)

IR Protection Development

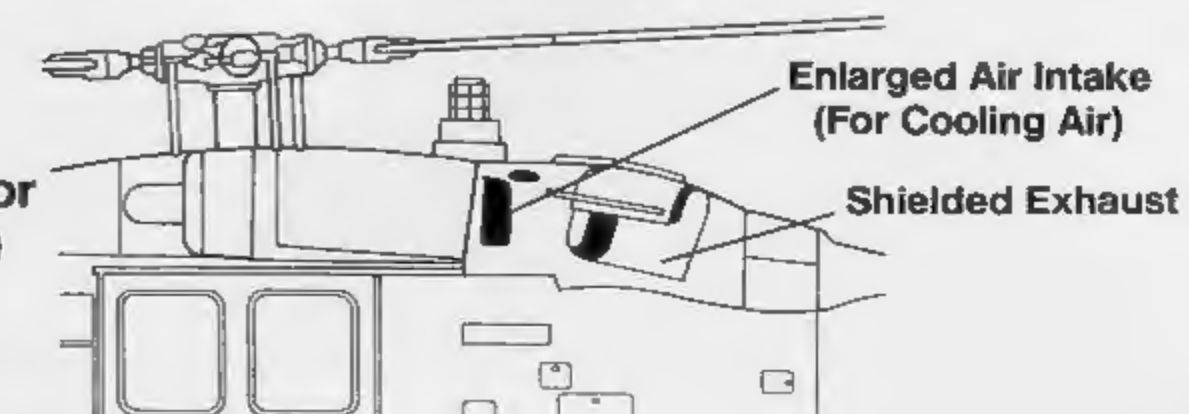
UH-60A
(Early)

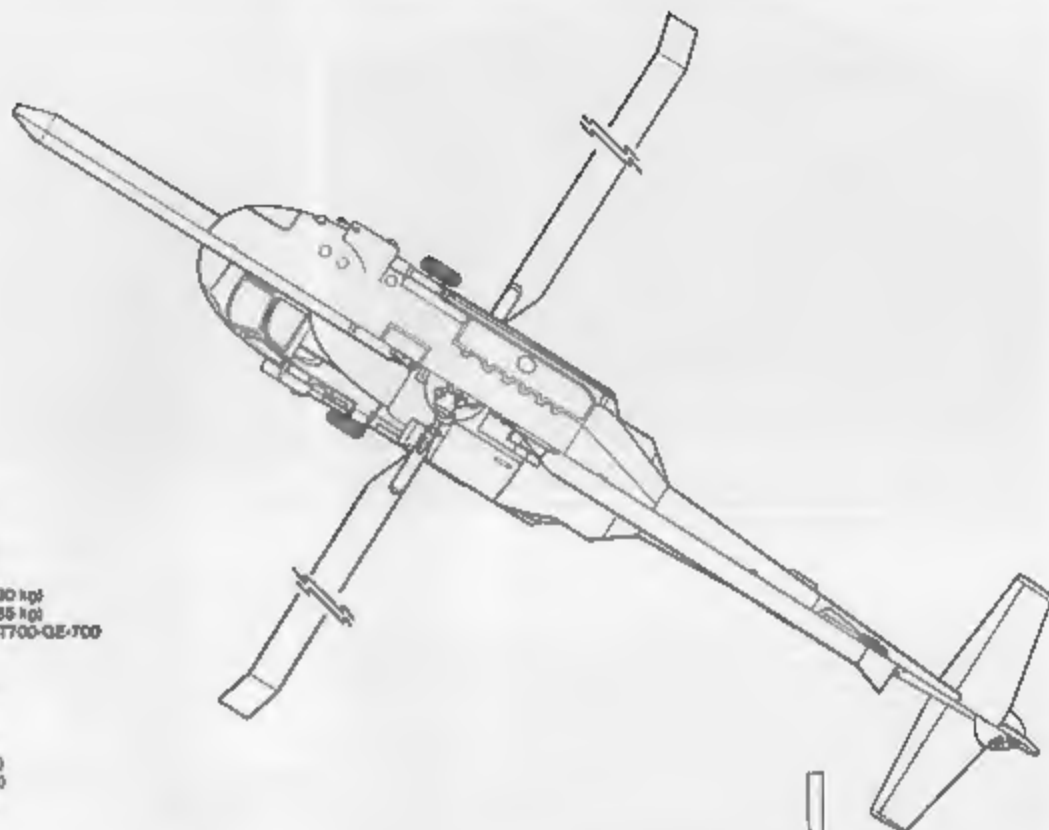


UH-60A
With IR Cruise
Suppressor



UH-60A
(Late)
Hover IR Suppressor
Subsystem (HIRSS)





Specifications

UH-60A Black Hawk

Rotor Span 53.7 feet (16.36m)
 Length 64.8 feet (19.76m)
 Height 16.8 feet (5.13m)
 Empty Weight 10,640 pounds (4,830 kg)
 Maximum Weight 20,290 pounds (9,185 kg)
 Power Plants Two 1,643 SHP GE T700-GE-700
 turbo shaft engines

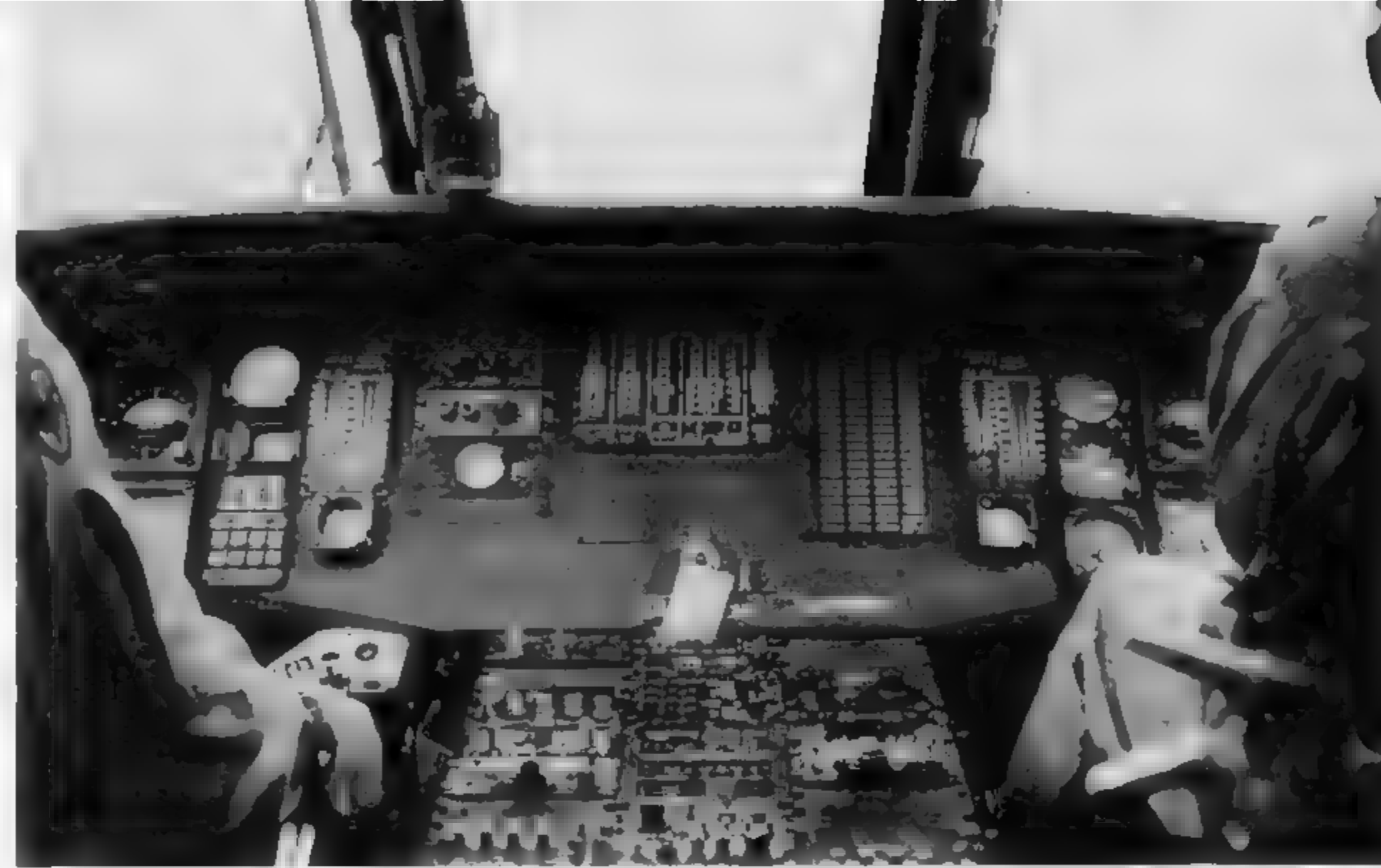
Armament Two M60 7.62mm
 machine guns

Performance
 Maximum Speed 182 mph (293 km/h)
 Service ceiling 19,300 feet (5,882m)
 Range 373 miles (600 km)
 Crew Three





The Black Hawk's troop seats are designed to provide protection in the event of a crash by absorbing some of the impact forces. Thirteen troop seats may be accommodated in the cabin (plus two for the crew chief/gunner). (Bryan Creel)



The Black Hawk's instrument panel uses both conventional dials and an LED display known as a "Chicklets" (in the center of the panel). These are color coded in Red, Yellow and Green to give the pilot the aircraft's status at a glance. (Mike Oldfield)

This UH-60A Black Hawk is equipped with the MILES laser engagement system for a training exercise. The strobe light, mounted in the box under the main gear sponson, flashes when the aircraft has been "shot down." (Bryan Creel)



This UH-60A of the 3rd Armored Division is equipped with the Cruise Infrared Suppression system over the engine exhaust. This system was used as an interim system until the improved Hover Infrared Suppression System (HIRSS) became available. (Thomas Gruenewald)





Cold weather and mountain flying presents a special challenge to UH-60A pilots. Landings on snowy slopes cause unpredictable air currents and "white-outs" from the rotor downwash. This UH-60A has just inserted special forces troops in the mountains near Bad Tolz, Germany. (Richard Berthold)



The pilot of this UH-60A flying over the Saudi desert during Operation DESERT SHIELD has put a flak jacket in the chin bubble as a precaution against small arms fire. The aircraft has been modified with wire cutters on the fuselage ahead of the rotor mast and on the landing gear legs. (Anthony Collins)

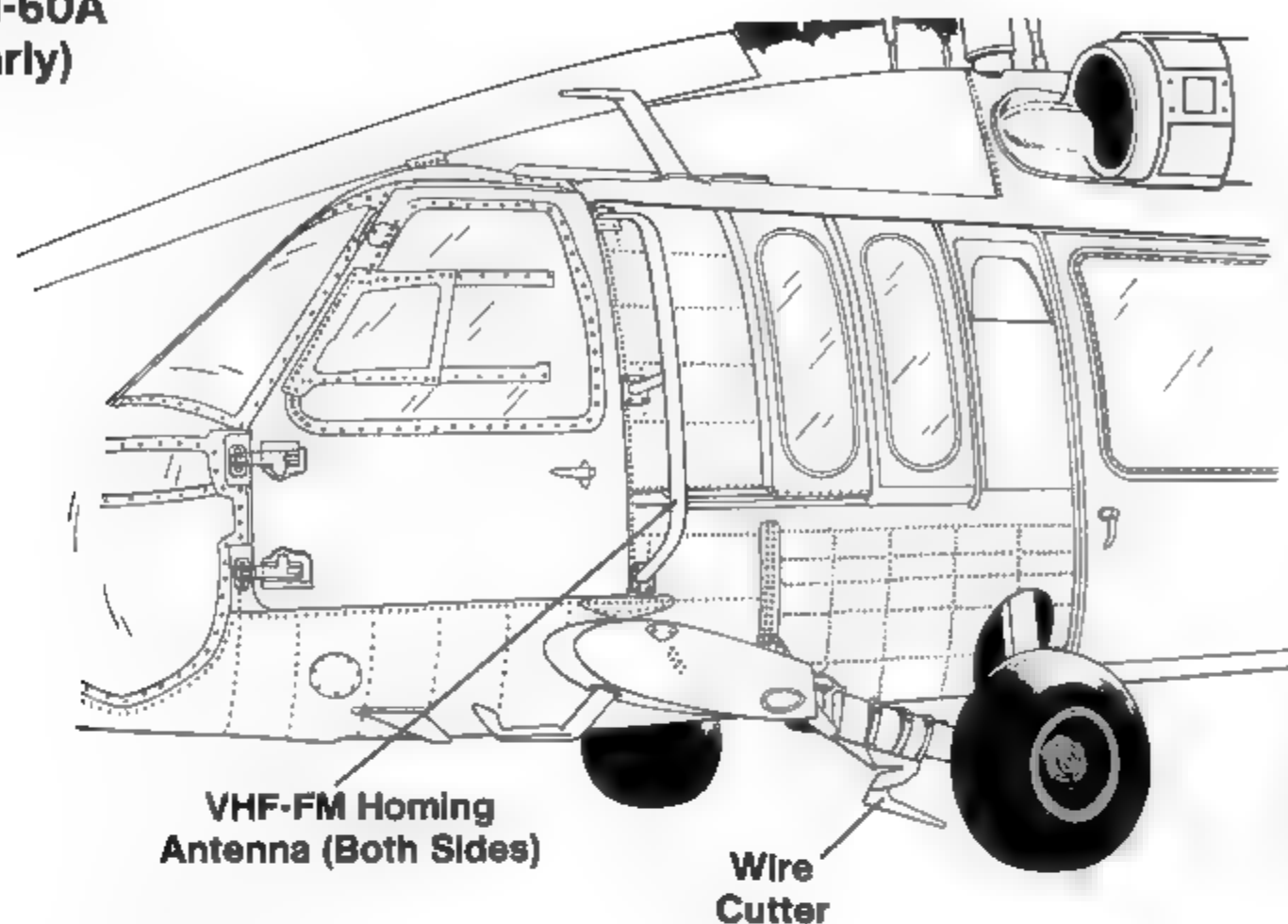
The Black Hawk's tail rotor was tilted 20 degrees off the vertical to contribute to lift, as well as providing anti-torque thrust. This UH-60A is equipped with the HIRSS and the External Stores Support System (ESSS) stub wing. (Bryan Creel)

This UH-60A, parked on the Saudi desert, has been modified to accept the External Stores Support System stub wing. The mounting for the wing is the bulged fairing just in front of the cargo cabin door. The small box on the rear fuselage side is a chaff/flare dispenser. (Anthony Collins)

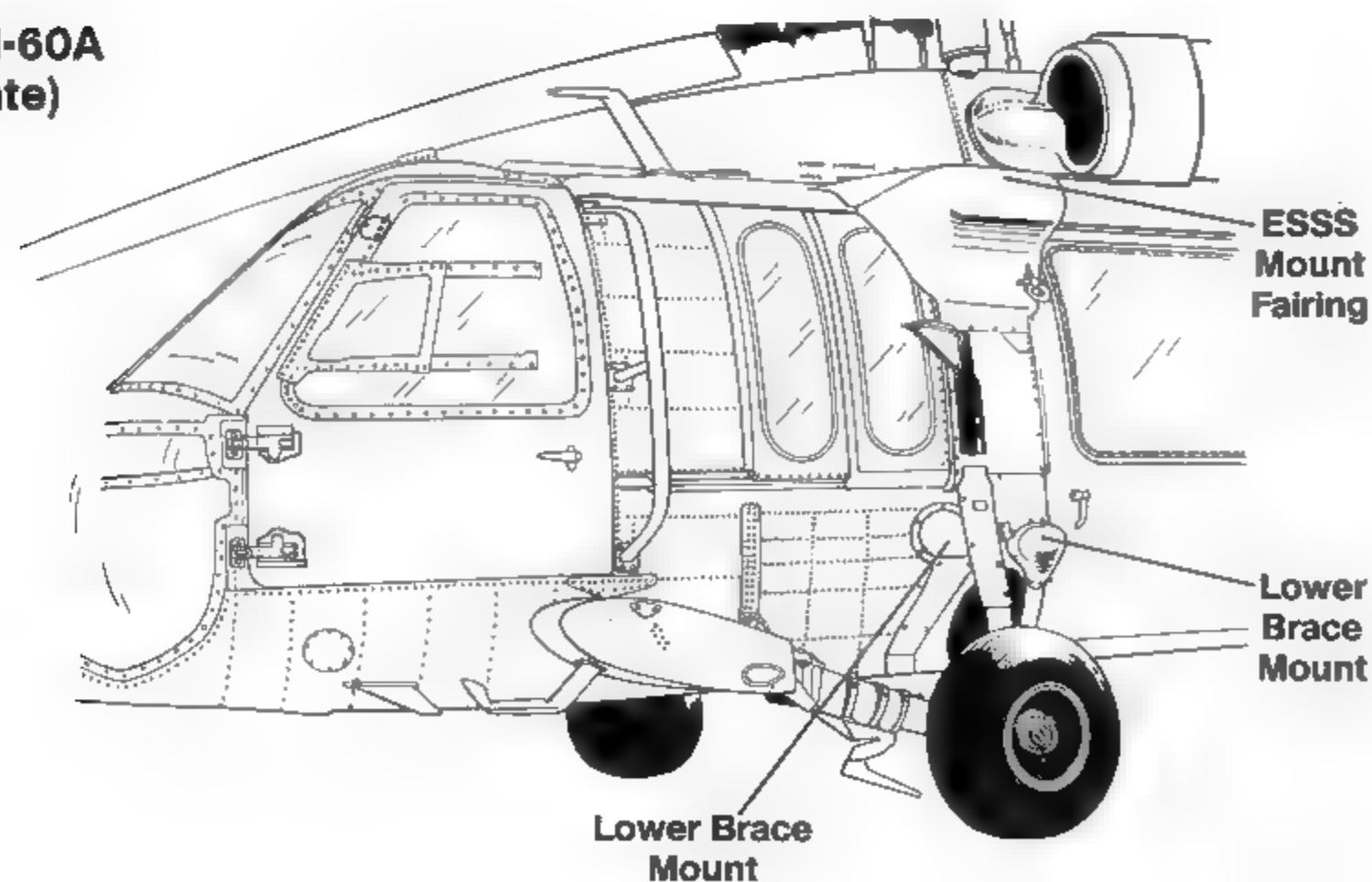


External Stores Support System Mounts

**UH-60A
(early)**



**UH-60A
(Late)**



CW3 Thomas Gruenewald stands in front of an MH-60A "Velcro Hawk" equipped with a chin mounted FLIR, Chaff/Flare dispenser and a Sanders ALQ-144 Infrared Jammer (Disco Light). CW3 Gruenewald flew this aircraft while based in Panama. (Thomas Gruenewald)

Special Operations Units are required to qualify for ship board operations to allow them to be deployed anywhere in the world. This MH-60A makes a deck landing with cabin doors opened and the cockpit doors removed to facilitate a quick exit in the event of a ditching. (Thomas Gruenewald)



Electronic Hawks

EH-60A/C Quick Fix

The EH-60A/C Special Electronic Mission Aircraft (SEMA) was basically a UH-60A outfitted with a 1,800 pound Quick Fix IIB electronics package that allows the aircraft to intercept, monitor, locate and jam enemy radio transmissions. Externally the EH-60A/C Quick Fix differs from the basic UH-60A Black Hawk by the installation of four dipole antennas mounted on the fuselage and a retractable whip antenna mounted under the fuselage. The prototype installation made its first flight on 24 September 1981 and the following test program was completely successful. Original plans called for the conversion of some 130 UH-60As to the EH-60 configuration.

The EH-60A Quick Fix contains an electronics package that can intercept, monitor, locate and jam enemy radio broadcast. The Quick Fix Black Hawks are equipped with four dipole antennas on the rear fuselage and a retractable whip antenna under the fuselage. (Sikorsky)

Before the conversion program got into full swing, the Army elected to update the aircraft and redesignate them as EH-60C. Due to budget cuts, the original program was cut back and only sixty-six EH-60Cs were completed. The last of these were delivered to the Army in September of 1988.

YEH-60B SOTAS

The YEH-60B was another conversion of a UH-60A Black Hawk to meet the Army's Stand-Off Target Acquisition System (SOTAS) requirement. The prototype first flew in February of 1981 with a large, rotating Motorola radar antenna mounted under the fuselage. The position of the radar antenna required the installation of long extendable telescopic main landing gear legs to provide ground clearance during landing and ground maneuvering. This version of the Black Hawk never went into production since development was halted in September of 1981 in favor of the J-STARS program.





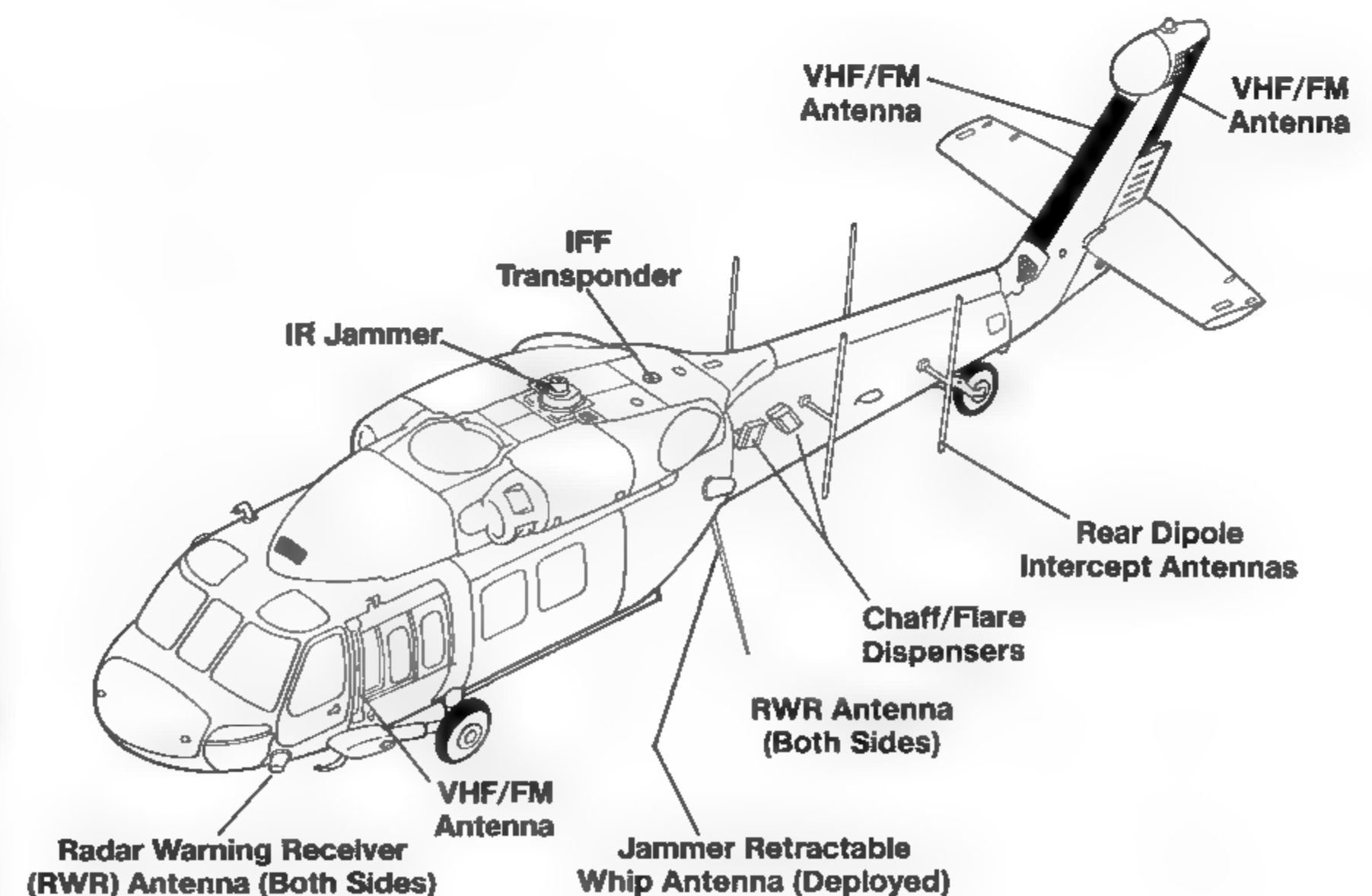
The long whip antenna is used to jam enemy radio broadcast, while the four dipole antennas mounted on the rear fuselage are used for direction finding. This EH-60C is also equipped to carry the ESSS stub wing as indicated by the ESSS fairing between the crew chief's window and main cabin door. (Sikorsky)



The EH-60A carries a crew of five, consisting of pilot, copilot, crew chief and two operators for the Quick Fix electronics package. Since it was a conversion of the UH-60A, the EH-60A uses the same T700-GE-700 engines and power train. (Sikorsky)

EH-60A Antenna Configuration

Three EH-60A/Cs are assigned to each division and armored cavalry regiment. This EH-60A is an early conversion being tested during the aircraft's development program and does not have the ESSS mount or wire strike wire cutters. (Sikorsky)



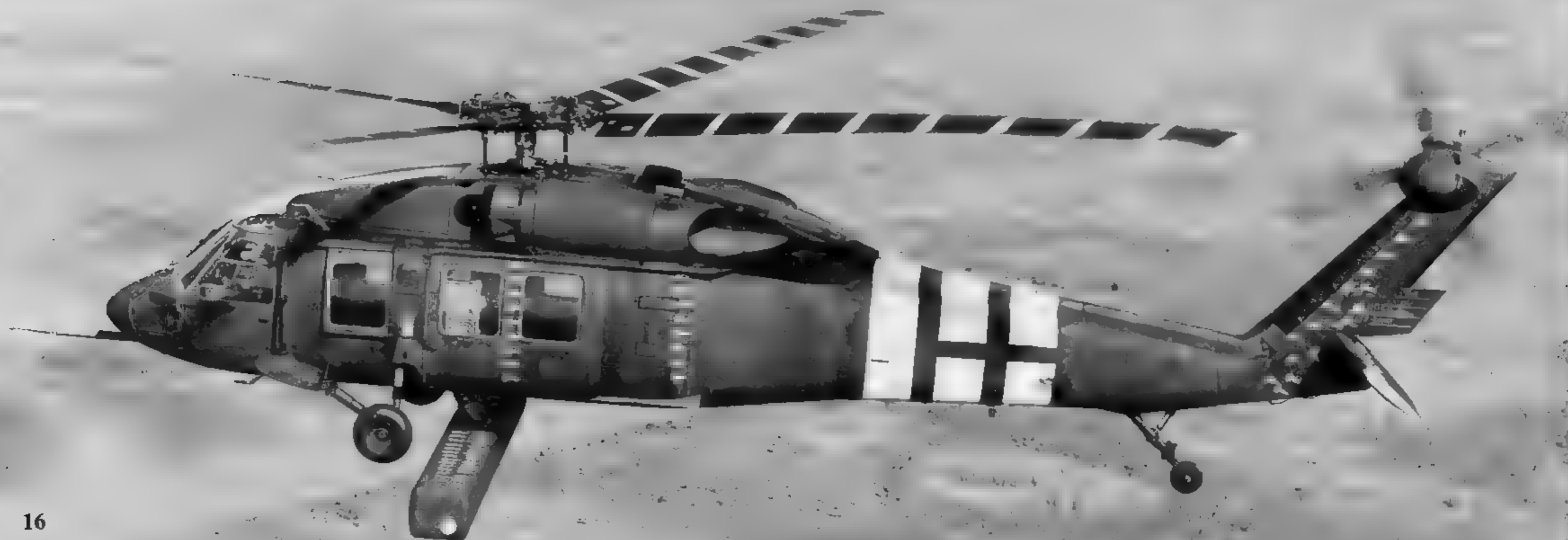


The long extended landing gear of the YEH-60B SOTAS was installed to create room under the aircraft for a large rotating radar antenna. The aircraft was thoroughly tested with the new landing gear before the radar was actually installed. (Sikorsky)



This YEH-60B SOTAS prototype prepares to land after completing a test flight. The Motorola radar has been stowed under the fuselage and the retractable landing gear is fully extended for landing. (Sikorsky)

The YEH-60B SOTAS never went into production since the Army decided to put the money it would have cost into the JSTARS Program, which more than proved its worth during the Gulf War. The large rotating radar and long, retractable landing gear definitely made for an unusual looking Black Hawk. (Sikorsky)



MH-60K Special Operations Aircraft (SOA)

The MH-60K was designed to perform Special Operations Mission (SOA) for the Army's Special Forces, Rangers and other recon/covert operations units. The aircraft is equipped with terrain avoidance radar and FLIR (Forward Looking Infrared) systems in a nose mounted radome and under fuselage turret. These systems allow the MH-60K to fly low level at night and under adverse weather conditions.

Survivability is enhanced by the addition of Radar Warning Receiver (RWR) button antennas on the nose and tail. The aircraft also carries a pair of M130 chaff/flare dispensers, one on each side of the fuselage and an AN/ALQ-144 IR pulse jammer (Disco Light) on the upper fuselage. These systems can be activated/deployed manually or automatically by the onboard active Aircraft Survivability Equipment (ASE) system.

The MH-60K Special Operations Aircraft carries special electronics equipment to maximize its survivability behind enemy lines. Sensor antennas on the landing gear sponsons, cockpit doors, on the rear of the tail rotor pylon and above the cockpit provide the crew with missile launch and laser illumination warning. (Sikorsky)

A key to the K-model's ability to provide maximum mission capability and reduce aircrew workload is the IBM Integrated Avionics Subsystem which integrates the Navigation/Communications (NAV/COMM), ASE and other aircraft systems. NAV/COMM systems include: a Global Positioning System (GPS), TACAN, Doppler, IFF, Satellite Communications (SATCOM) and Inertial Navigation Unit (INU). A radar altimeter is also provided for precise altitude indications at night and in adverse weather.

The MH-60K uses the basic UH-60A Black Hawk airframe with additional structural reinforcements. It is powered by two 1,857 shp General Electric T700-GE-701C turboshaft engines and is equipped with an external hoist, folding stabilator, HIRSS and rotor brake. The stub wings on the MH-60K differ from the stub wings on the UH-60A in that they are up-swept. These wings mount two 230 gallon fuel tanks and there are provisions for mounting AIM-92A Stinger AAM tubes on the wingtips.

Additionally, the MH-60K is configured for in-flight refueling with the probe being mounted on the starboard fuselage side. The MH-60K carries heavier defensive armament than the MH-60A with the M134 Miniguns being replaced by a pair of Browning M2HB.50 caliber machines guns.

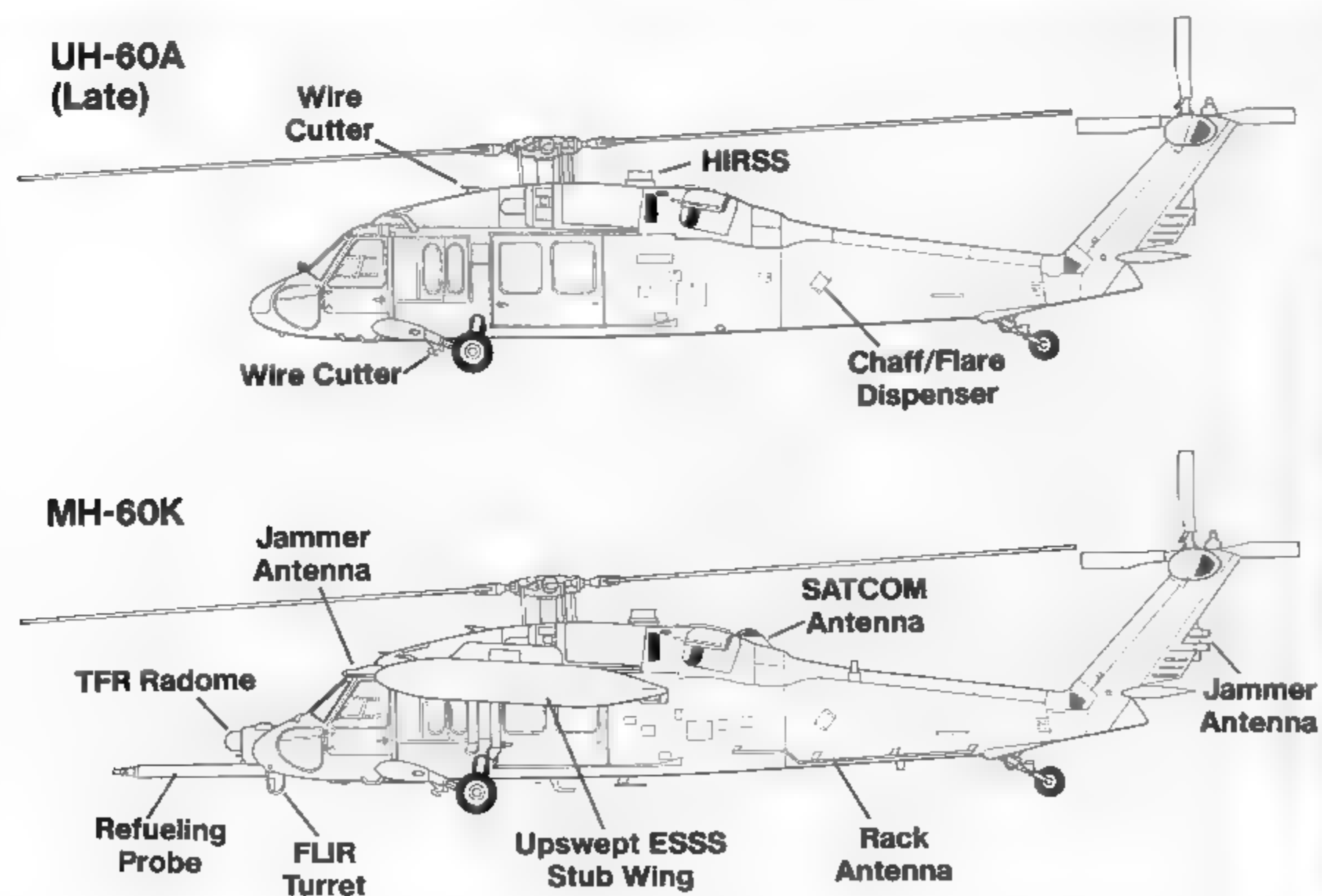
The Army has awarded Sikorsky a contract for twenty-two MH-60Ks with deliveries to be completed between mid-1992 and mid-1993. Additionally, there is a stated requirement for another thirty-eight aircraft. Initial deliveries are going to outfit the 1st Battalion of the 160th Special Operations Aviation Regiment at Fort Campbell, KY.





Fuselage Development

The MH-60K prototype was turned over to the Army in August of 1991 for extensive flight testing. The MH-60's integrated, CRT equipped cockpit reduces crew work load and enhances mission capability. Additionally, the MH-60Ks are more heavily armed with .50 caliber machine guns replacing the usual M60s. (Sikorsky)



To increase survivability and all weather performance, MH-60Ks are equipped with a nose mounted multi-mode radar, a chin mounted FLIR turret, Jammer antennas located just above the center windscreen and a SATCOM antenna on the rear fuselage decking. The in-flight refueling probe has been fitted with a temporary flight data sensor. (Sikorsky)



UH-60L

During 1989 the Army set about upgrading the UH-60A with new engines and an improved transmission under the designation UH-60L. The UH-60L differs from the standard UH-60A in the installation of more powerful 1,857 shp General Electric T700-GE-701C engines in place of the earlier 1,543 shp engines. The main transmission has also been upgraded to handle the increased engine power. All product improvements, such as HIRSS and ESSS, done throughout the UH-60A production cycle, were also included on the production UH-60L, along with improved flight controls and a revised tail rotor control system.

The increase in engine power enables the UH-60L to lift far greater loads (up to 9,000 pounds externally). Mission gross weight was increased to 23,000 pounds (up from 22,000 pounds for the UH-60A), although this is the upper limit of the performance envelope. Any further increase in gross weight/engine power will require some fuselage strengthening.

As of early 1992, the Army has received 131 UH-60Ls, while another twenty-two were converted to MH-60K standards and sixteen airframes were converted to MH/HH-60Gs. Although final numbers of UH-60Ls in Army service will depend on defense spending reductions, many analysts believe that a smaller Army will be expected to be even more airmobile than at present. This philosophy would protect programs such as the Black Hawk from budget cuts.

Future upgrades and improvements are another factor impacting on the final number of UH-60Ls produced. Sikorsky Aircraft is exploring the use of wider chord, composite main rotor blades and improved engines. Also being considered is a modernized cockpit with improved avionics, multifunction CRT displays and increased forward visibility.

This UH-60L Black Hawk was assigned to the Texas Army National Guard during November of 1992 and based at Naval Air Station Dallas, Texas. The Texas Army Guard was one of the first units to receive the UH-60L. The aircraft is powered by an uprated engine and has all the improvements progressively added to the UH-60A. (Eric Renth)



SSGT Rick Forman of the 2nd Battalion, 229th Aviation Regiment, 101st Airborne Division, mans an M60D machine gun in the crew chief's window of a UH-60L based at Fort Rucker, AL. Visibility and field-of-fire is excellent through the two piece forward opening windows. (Paul Pickett)

UH-60Q

The Army's search for a better equipped, longer range and more survivable MEDEVAC helicopter led to a plan to outfit the UH-60L for the medical role under the designation UH-60A "Dustoff." The UH-60Q will consist of a UH-60L airframe outfitted to handle nine litter patients. It will have enhanced avionics, an oxygen generation system, an external rescue hoist, improved cabin lighting, private cabin ICS, ventilators and specialized medical equipment. Additionally, the aircraft will be capable of the armed combat search and rescue mission (although at present the armament fit has yet to be determined).

As of early 1993, the aircraft has progressed to the full scale mock-up stage with production not scheduled to begin until some time in 1994.

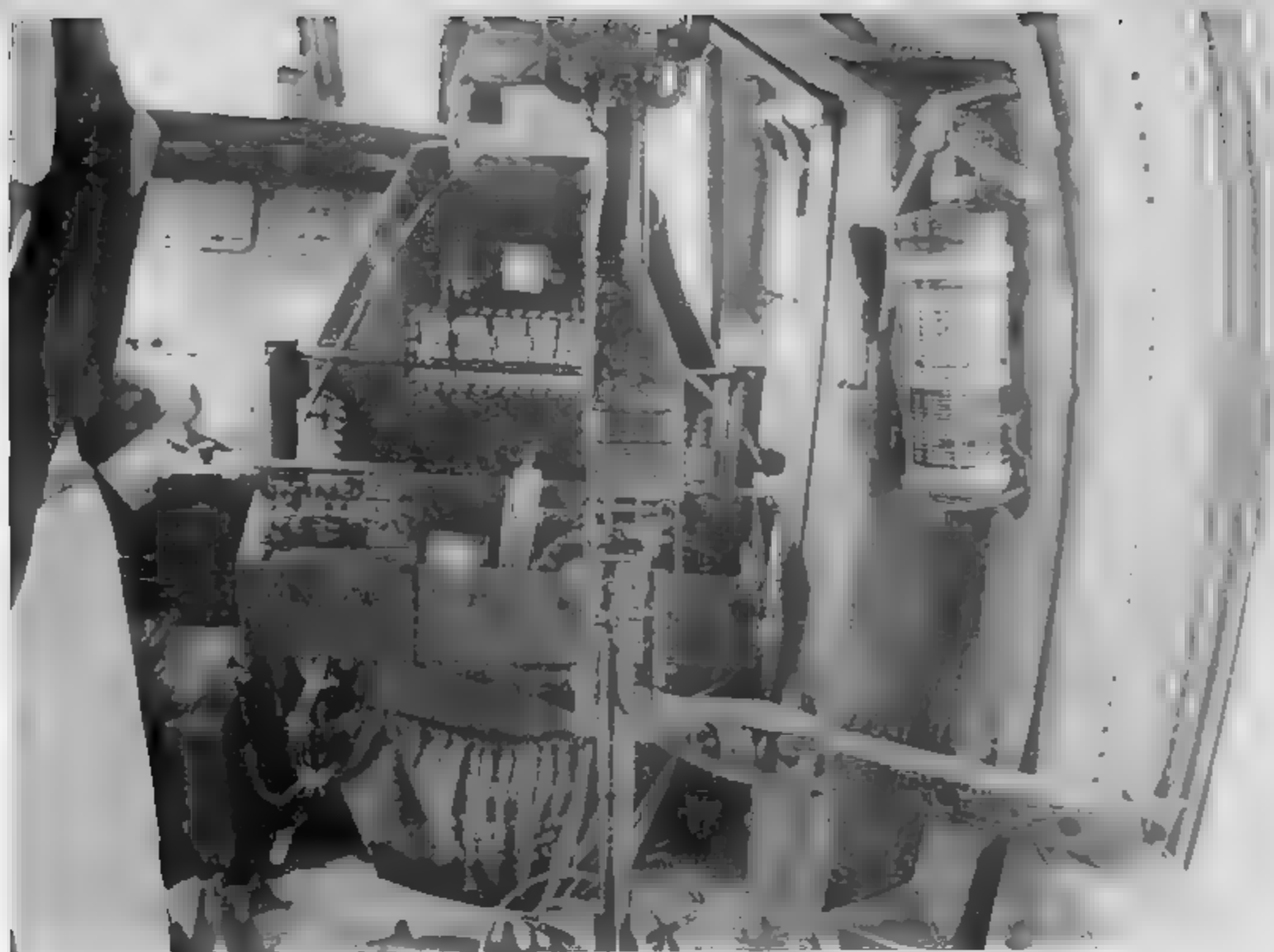
When fuel tanks are hung on the ESSS, they impose serious limitations on the fields-of-fire for the Black Hawk's M60D machine guns. Most crews have decided that they would jettison these stores, in the event they came under fire, to give the gunners a chance to return fire. (Paul Pickett)



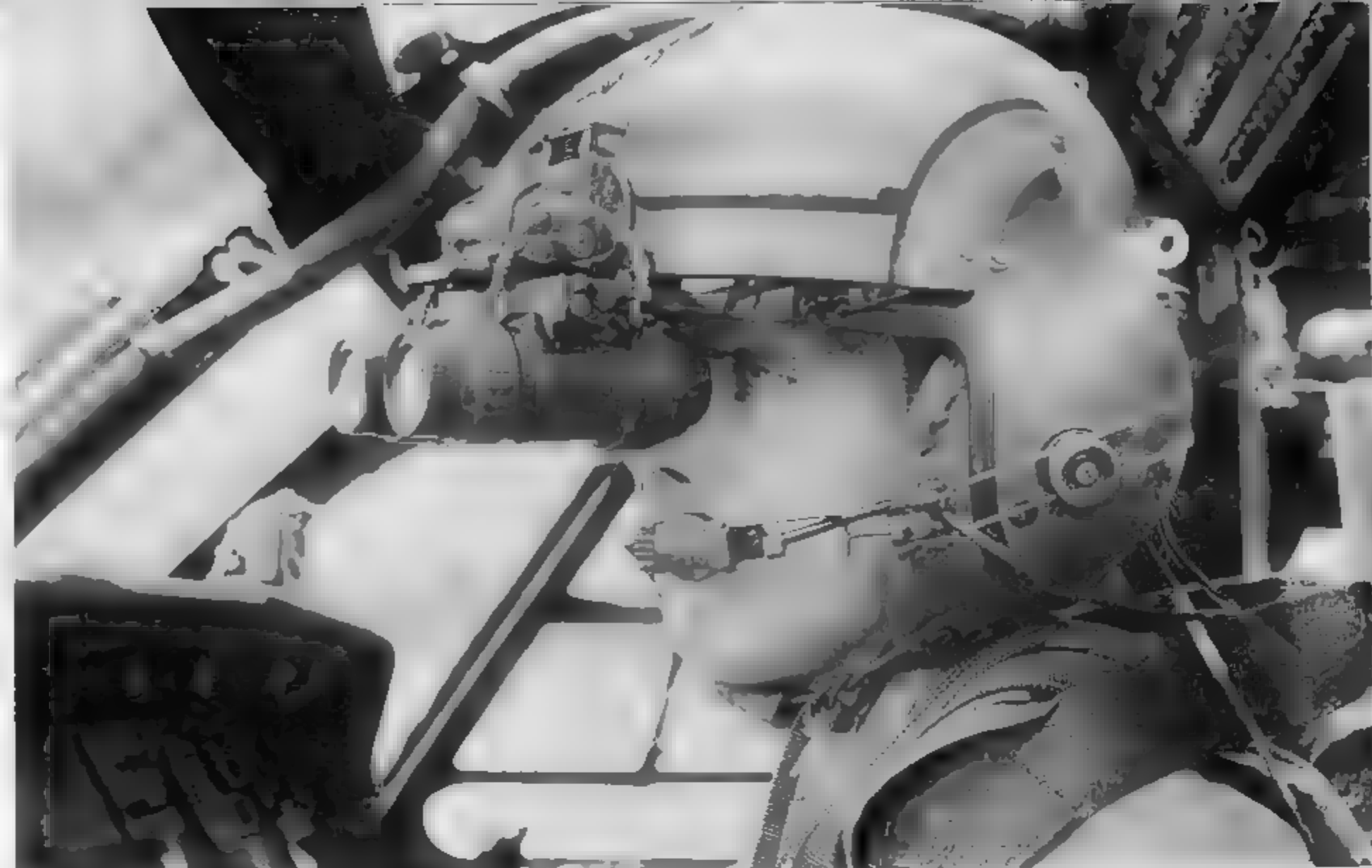
This UH-60L is configured as a Command and Control (C and C) aircraft with extra communications equipment installed in the aircraft to allow a unit commander to direct his forces. The aircraft has a number of specialized comm antennas on the fuselage. (Paul Pickett)

The small port just behind the HIRSS on this UH-60L Command and Control aircraft is the exhaust port for the T-62T Auxiliary Power Unit (APU). One of the two VOR blade antennas (standard on the UH-60L) is visible just below the United States Army fuselage markings. (Paul Pickett)





The M60D machine gun is locked in the stowed position just forward of the crew chief's seat. The crew of this UH-60L have mounted a paint brush next to the fire extinguisher to assist with removing sand from the gun and other equipment. (Paul Pickett)



Night Vision Goggles (NVGs), such as these AN/AVS-6 worn by CW2 Bryan Creel, have made helicopter operations at night a viable operation, although it takes special training for pilots to become proficient in their use. The NVGs flip up when not in use. (Paul Pickett)

The crew chief of this Black Hawk peers down through the cargo hook access hatch to observe the hook-up of an external load in its cargo net. This aircraft is also equipped with the MILES laser engagement system. (John Pruden)



The sand and heat of the Saudi Desert took its toll on aircraft and crews alike during Operation DESERT SHIELD. Rotor blades and engine compressor blades suffered the most from the fine sand, which some described as being like talcum powder. (Dan Cole)





This ESSS equipped Black Hawk is much easier to fly in the hover, thanks to the aircraft's Automatic Flight Control System (AFCS). This system helps maintain heading, allowing the pilot to concentrate on the liftoff. (Doug Martin)



The External Stores Support System stub wing can carry two 230 gallon fuel tanks (outboard) and two 450 gallon tanks on the inboard stations. Other ESSS options include up to sixteen Hellfire missiles, gun pods, 2.75 inch rocket pods and mine dispensers. (Bryan Creel)

Strip formation lights, called "slime lights" by Black Hawk crews, are mounted on the tips of the stabilator, on the tail rotor drive shaft cover and on the fuselage fairing between the HIRSS. (Stan Stacey)



The main rotor blades of the UH-60L consist of a titanium main spar with a Nomex honeycomb filler and fiberglass skin. The swept blade tips provide improved performance and reduce the rotor acoustic signature (noise level). (Paul Pickett)



Naval Hawks

SH-60B Seahawk

The SH-60B Seahawk was developed to fill the U.S. Navy LAMPS Mark III (Light Airborne Multipurpose System) helicopter requirement. The LAMPS III program once again had Sikorsky pitted against Boeing Vertol in the design competition. On 28 February 1978 the Navy authorized full scale development of the Sikorsky design under the designation SH-60 Seahawk.

The first prototype flew on 12 December 1979 and it differed from the UH-60 in a number of ways. The fuselage was modified with the forward cabin windows and port main cabin door being deleted. A large single piece window is installed in place of the port cabin door and a twenty-five tube sonobouy launcher was installed on the port fuselage just to the rear of the window. The airframe had to be sealed to protect it against salt water spray.

Two weapons pylons were added to the fuselage sides to allow for the carriage of external stores such as torpedoes. To reduce the aircraft's "footprint," the tailwheel was relocated forward and changed to a twin wheel oleo configuration. The Seahawk is also equipped with several features to permit stowage in confined areas including: an electrically powered main rotor blade folding system, a rotor brake, folding stabilator and folding tail rotor pylon.

To aid in landing on a pitching, rolling deck in adverse weather, the aircraft is outfitted with the RAST (Recovery Assist Secure and Transversing) system. This consists of a hauldown cable which is attached to the external cable hookup on the Seahawk while the aircraft hovers over the landing pad. The aircraft is then winched down to a secured landing and then is locked into a track for movement into the ship's hangar.

The other major external changes to the Seahawk airframe are related to the aircraft's mission equipment package (MEP). The MEP involves the sensors and equipment required to accomplish the Seahawk's two primary missions: anti-submarine warfare (ASW) and anti-ship surveillance and targeting (ASST).

To help accomplish both missions, the Seahawk is equipped with a Texas Instruments AN/APS 0124 search radar mounted in a shallow ventral radome under the cockpit. The radar has a 150 mile range, providing the battle group commander with an extended picture of the surface threat tactical situation. The Seahawk radar can provide a stand-off targeting capability for the battle group's surface to surface missiles. Additionally, the SH-60 is equipped with the AN/ALQ 142 passive ESM system which employs four antennas (two on the nose, and one on each side of the fuselage). This system allows the SH-60 to detect hostile electronic emissions for accurate targeting on enemy threat platforms.

To perform in the ASW role, the Seahawk carries a twenty-five sonobouy launcher on the port side with a total capacity of 125 sonobouys. These can be pneumatically ejected in single, ripple or salvo modes. The Seahawks also carries a Magnetic Anomaly Detection (MAD) bird on its own pylon/winch on the starboard fuselage side. Normal armament loads for the SH-60 include: Mk 46 ASW torpedos, depth charges and air to surface missiles such as the Penguin Mk 2.

The SH-60B performs other roles such as medical evacuation, search and rescue (with an external rescue hoist over the starboard cabin door) and vertical replenishment. The crew normally consists of a pilot/aircraft commander, an airborne tactical officer



A pair of SH-60B Seahawks of Light Anti-Submarine Helicopter Squadron Forty (HSL-40) fly in formation over the Space Shuttle's main fuel tank and booster rockets on the launch pad at the Kennedy Space Center. The lead aircraft has a cover installed over the sonobouy launch tubes. (Navy)

and a sensor systems operator.

The first production aircraft flew on 11 February 1983, and in 1991 the first Seahawks to feature the Block I upgrade began roll off of Sikorsky's final assembly line. This upgrade includes: an improved 99 channel sonobuoy receiver, Global Positioning System, a number of reliability and maintainability improvements and formal integration of the Penguin anti-ship missile system. Another important part of the upgrade was the incorporation of an infrared jammer, chaff/flare dispensers, a radar warning system and a pintle mount for an M60 machine gun.

Current plans also call for a Block II upgrade beginning in late 1997. This upgrade would add a dipping sonar, an improved radar, an improved mission processor and a modernized cockpit with full color CRT displays.

Early Seahawks were powered by two 1,690 shp General Electric T700-GE-401 turbo-shaft engines. From mid-1988, the Seahawk was re-engined with the 1,900 shp GE T700-GE-401C engine. Of the 260 SH-60Bs the Navy has planned, over 150 are presently in service.

SH-60F Carrier (CV) Helo

The SH-60F CV-Helo was developed from the standard SH-60B to fill the Aircraft Carrier (CV) inner-zone ASW mission and was intended to replace the SH-3H Sea King. The basic airframe and power plant of the SH-60B were retained but significant changes were made to the mission related equipment package. The MAD equipment, sonobuoys,

The SH-60B Seahawk is a rugged and reliable anti-submarine warfare aircraft. It is equipped with sonobuoys which are ejected from the twenty-five tubes visible just to the rear of the cabin window on the port side and a MAD "bird" which is mounted on a pylon on the starboard side. (Sikorsky)

RAST package or search radar were replaced by a Bendix AN/AQS-13F active dipping sonar, a Teledyne tactical data and communications control system, auxiliary fuel system and an additional weapons pylon is fitted on the port side. The weapons pylons are also plumbed to accept long range fuel tanks.

The first production SH-60F made its first flight on 19 March 1987 and by early 1991 some thirty-six aircraft had been delivered. The first fleet deployment of the SH-60F took place aboard USS NIMITZ during 1991. A change took place on the production line during September of 1991 when the Global Positioning System (GPS) was incorporated into production SH-60Fs. Aircraft already delivered are scheduled to be retrofitted with GPS during their regular overhauls.

Even though the CV-Helo is well equipped to perform its mission, it was designed to accommodate future improvements. Provisions are built into the airframe to accept a surface search radar, FLIR, night vision devices, as well as improved sensors and weapons. The Navy has stated a requirement for 175 SH-60Fs with approximately fifty aircraft already in service. The actual production figures will depend on the number of aircraft carriers deployed by the Navy in the future.

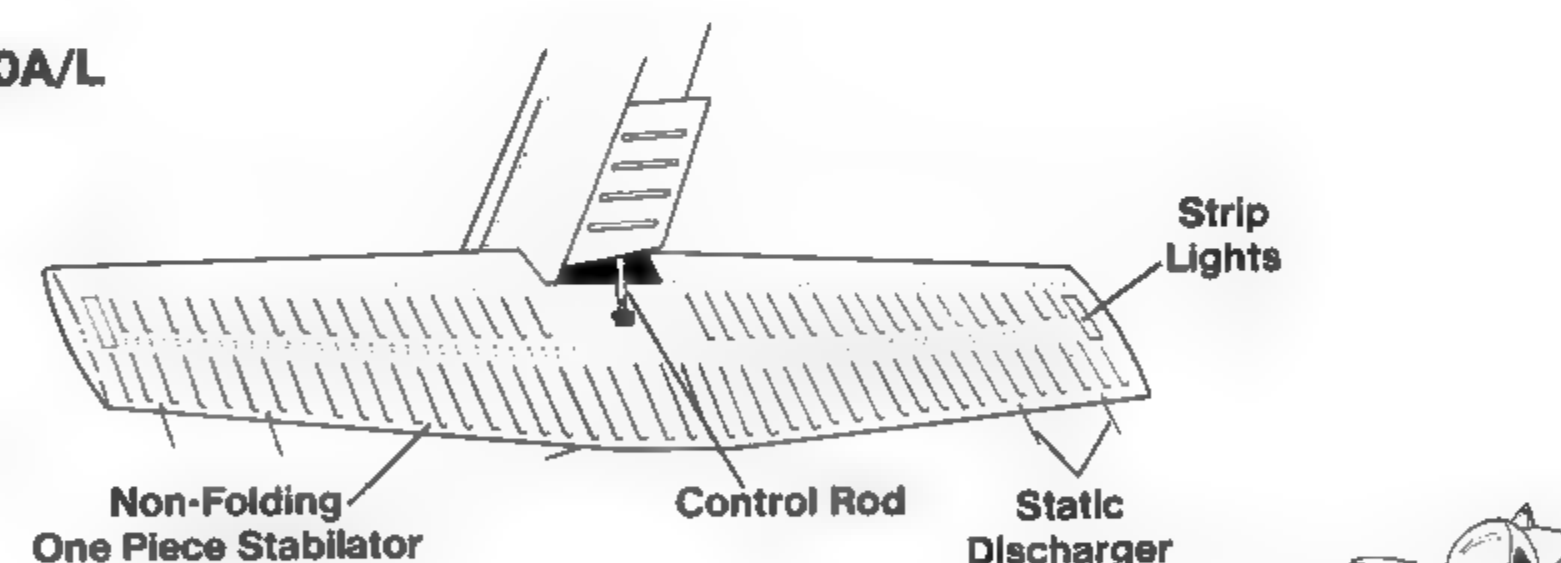
HH-60H Helicopter, Combat Support (HCS)

The HH-60H was based on the SH-60B/F airframe and retained the same engines, landing gear and other subsystems. The aircraft differs from the SH-60F primarily in mission equipment. The first HH-60H flew on 17 August 1988 and was put into service by

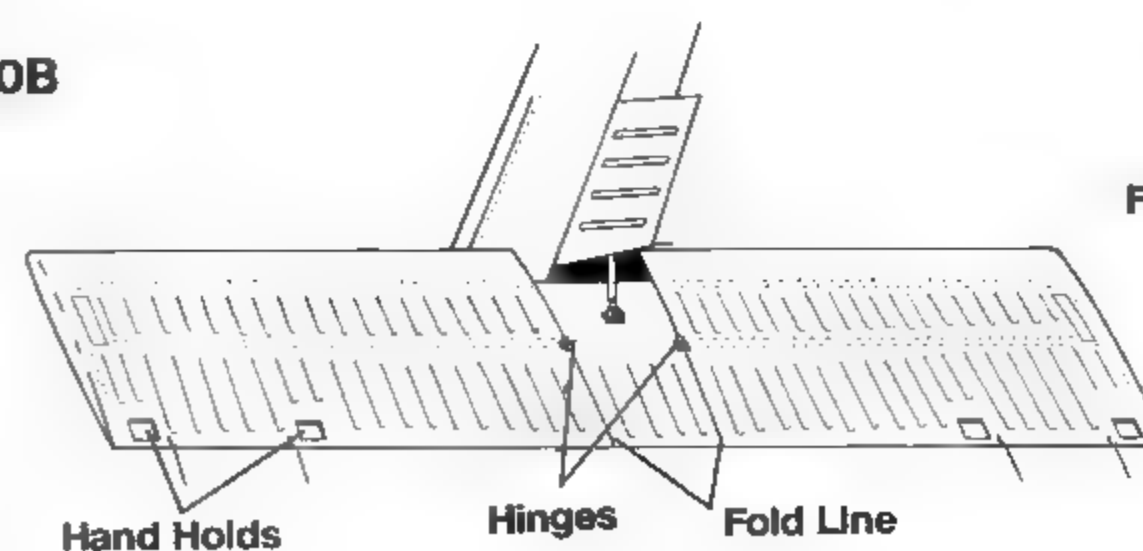


Folding Stabilator

UH-60A/L



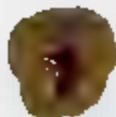
SH-60B



The UH-60K Black Hawk of the 101st Airborne was named Midnight Blue



THE RIFLEDEL IT was assigned in the 1stst Airborne and carried the unit insignia on the rotor in BLACK.

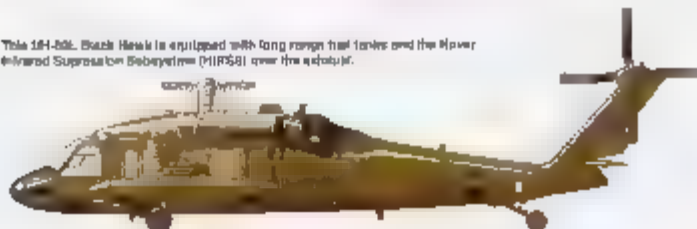


This OH-69 Jayhawk was assigned to Light Amphibious Helicopter Squadron 40 (HSL-40) and carried the squadron insignia on the fuselage in Dark Grey.



This UH-60L Black Hawk is equipped with long range fuel tanks and the Hovey Enhanced Suppression Saboteur (HRESS) over the cockpit.

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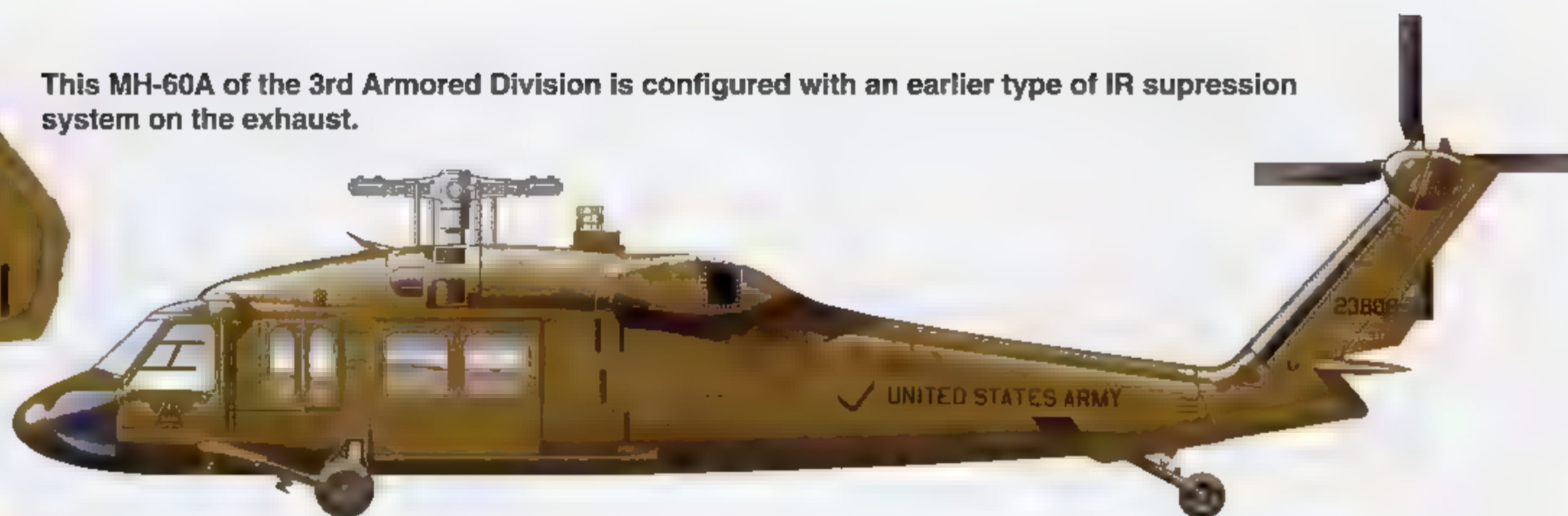
The U.S. Coast Guard flies a number of MH-60L Jayhawk search and rescue helicopters from land bases.





Unit insignia

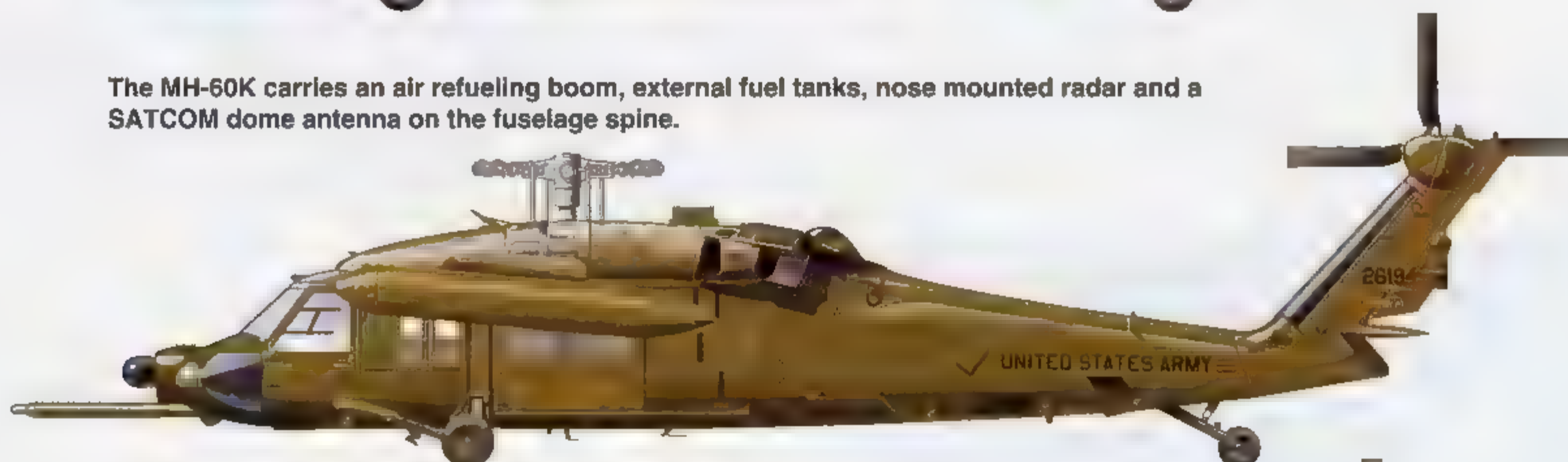
This MH-60A of the 3rd Armored Division is configured with an earlier type of IR suppression system on the exhaust.



The Air Force uses the MH-60G Pave Hawk as an armed special operations and combat rescue helicopter.



The MH-60K carries an air refueling boom, external fuel tanks, nose mounted radar and a SATCOM dome antenna on the fuselage spine.



This S-70A was purchased by the Bahrain Government as a VIP transport with a special interior and tinted windows.



This VH-60 is assigned to Advanced Marine Helicopter Squadron One (HMX-1) at Quantico, VA as a Presidential support helicopter.



HCS-4 at Norfolk, VA during January of 1990. Eighteen aircraft have been purchased by the Navy with another twenty-four expected.

The primary mission of the HH-60H is combat strike rescue and special warfare support. Current Navy strike rescue doctrine calls for the extraction of downed aviators under all weather conditions while avoiding enemy threats. With this in mind, the HCS has been equipped with an IR jamming system, chaff/flare dispensers, radar warning receivers and an HIRSS. The aircraft carries a radar altimeter, Doppler radar, multifunction cockpit video displays and night vision goggle compatible lighting to help to insure mission completion under most weather conditions. The aircraft is armed with two M60D machine guns on pintle mounts in the cabin and has provision for weapons pylons on either side of the fuselage.

In the strike rescue role, the HH-60H can recover four downed aviators within a 250 nautical mile radius of the carrier, while in the special warfare support role, eight SEALs may be airdropped within a 200 nautical mile radius. The aircraft can operate from a number of different platforms including: frigates (FFG-7 Class), destroyers (DD-963 Class) and cruisers (CG-47 Class) as well as unprepared sites ashore. The HH-60H equips two squadrons: HCS-4 at Norfolk and HCS-5 at Point Magu, CA.

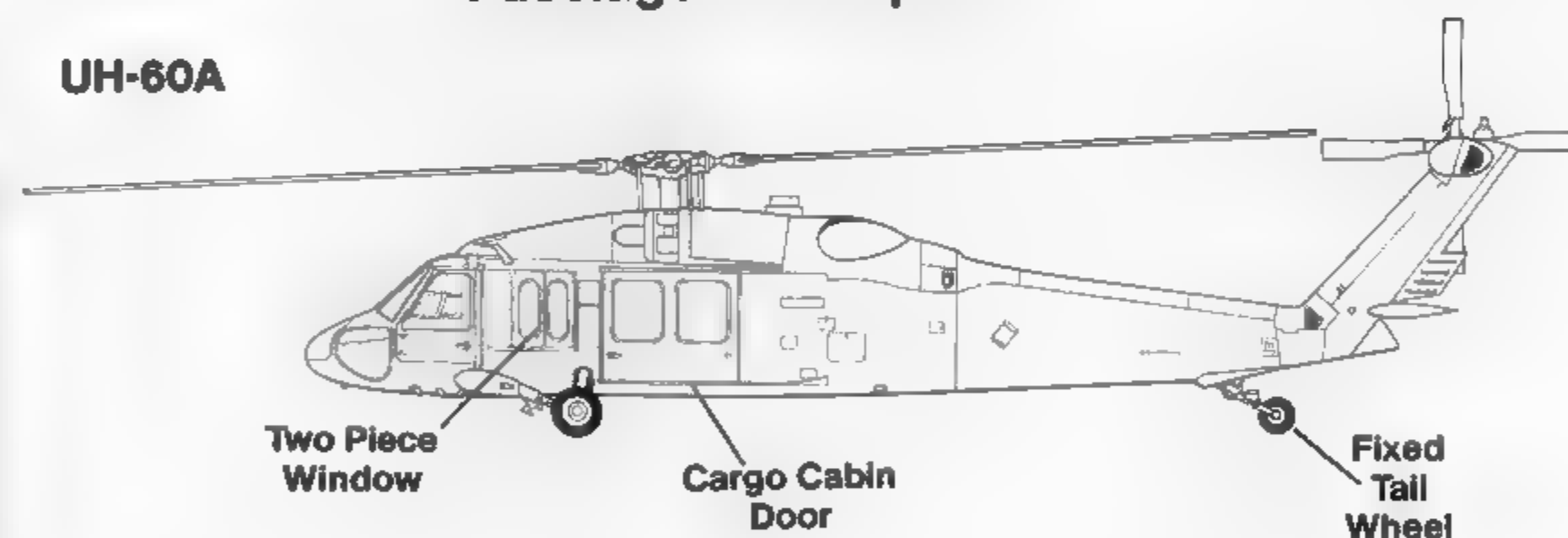
The Navy plans to equip the SH-60B Seahawk to carry and fire the AGM-119 Penguin Mk 2 Mod 7 infrared homing anti-ship cruise missile for the anti-ship role. This SH-60B is also carrying a training dummy Mk 46 anti-submarine torpedo on the fuselage pylon. (Navy)

This SH-60B Seahawk of Light Anti-Submarine Helicopter Squadron Forty (HSL-40) is based in Mayport, Florida. HSL-40 is a Replacement Air Group that trains aircrews for operational fleet SH-60B squadrons. (Navy)

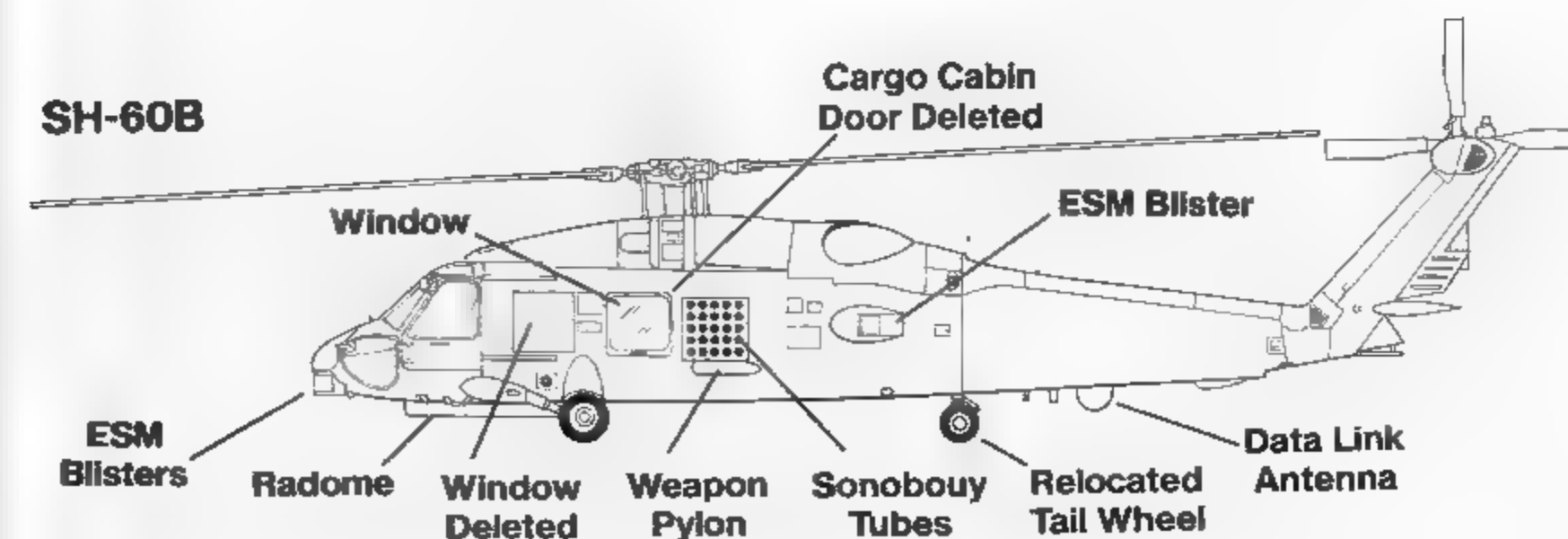


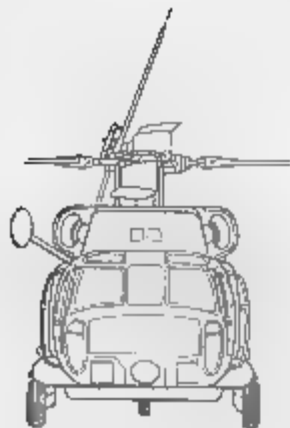
Fuselage Development

UH-60A



SH-60B





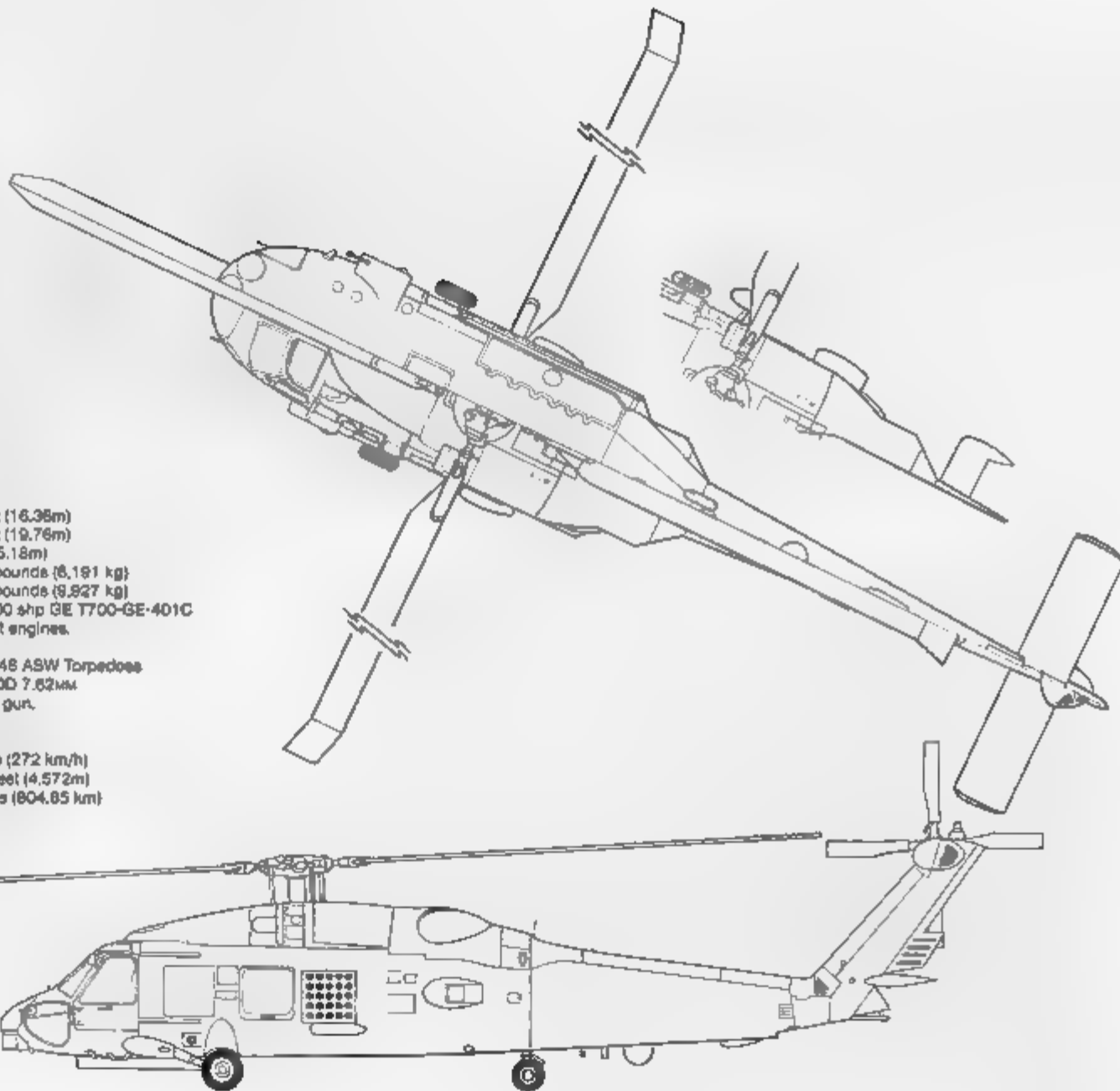
Specifications

SH-60B Seahawk

Motor Span.....	53.7 feet (16.35m)
Length.....	54.8 feet (16.76m)
Height.....	17 feet (5.18m)
Empty Weight.....	13,648 pounds (6,181 kg)
Maximum Weight.....	21,884 pounds (9,927 kg)
Power Plants.....	Two 1,900 shp GE T700-GE-401C turboshaft engines.

Armament.....Two Mk 48 ASW Torpedoes
One M800 7.62mm
machine gun.

Performance	
Maximum Speed	170 mph (272 km/h)
Service ceiling	15,000 feet (4,572m)
Range	500 miles (804.85 km)
Crew	Three





The SH-60F differs from the earlier SH-60B primarily in the mission equipment installed. The SH-60F replaces the search radar, sonobouys and MAD gear with a dipping sonar and enhanced ASW avionics. This SH-60F Ocean Hawk is assigned to HS-4 aboard the USS KITTY HAWK (CV-63). (Sikorsky)



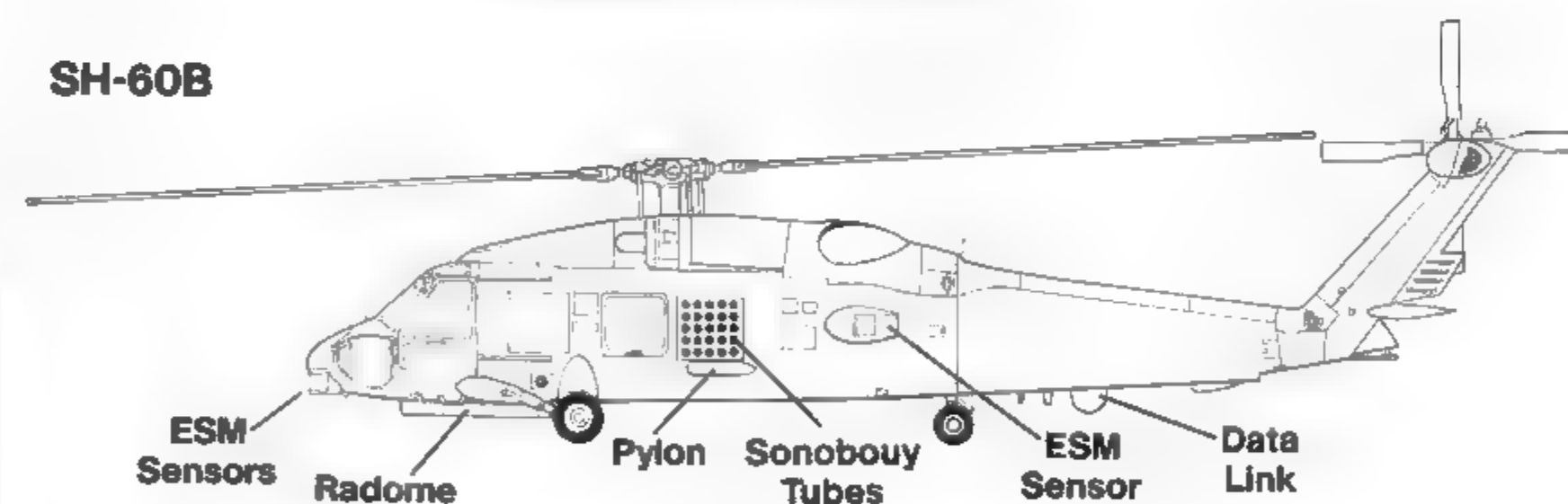
This SH-60B of HSL-40 parked on the ramp at NAS Mayport, Florida has the forward sliding fuselage fairing opened revealing the flight control system, hydraulic pumps and other engine accessories. (Author)

Fuselage Development

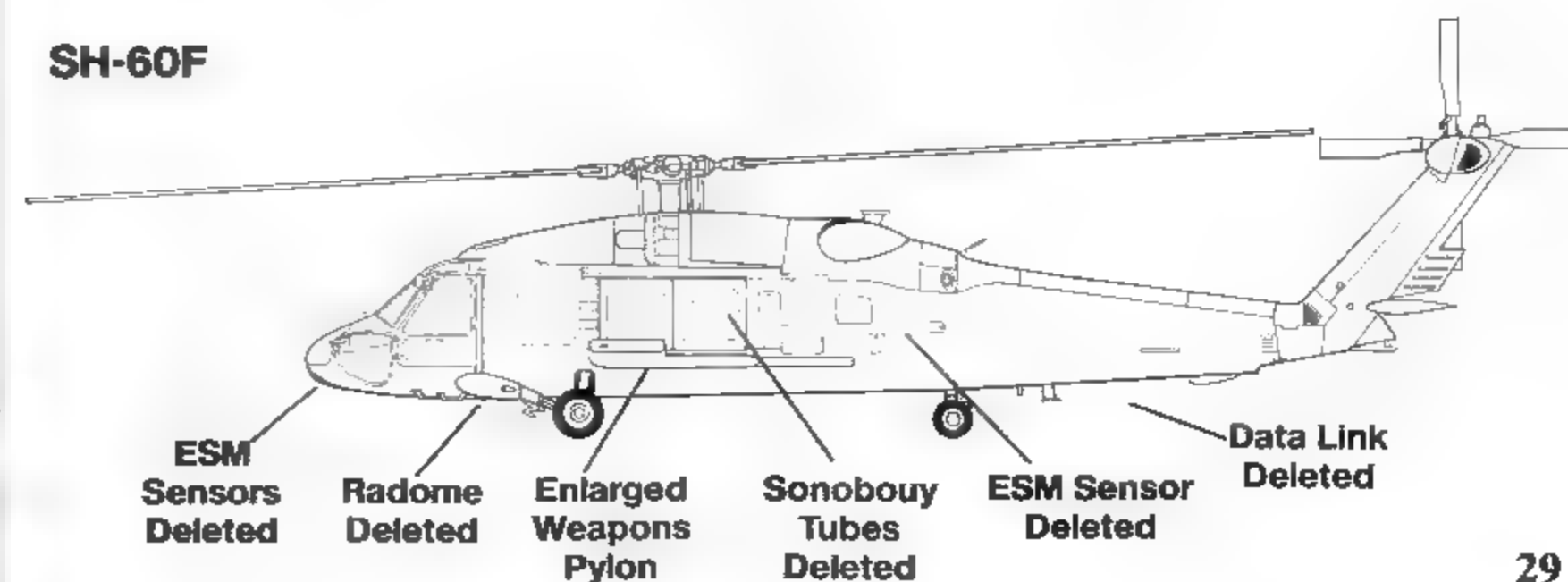
This SH-60F of HS-4 aboard USS KITTY HAWK is bringing in a sling load of supplies. Vertical Replenishment (VERTREP) is an important secondary mission for the SH-60F. (Sikorsky)



SH-60B



SH-60F





This SH-60F of Helicopter Anti-submarine Squadron Two (HS-2) is stationed aboard the USS NIMITZ as part of Carrier Air Wing Eight (CVW-8). The aircraft carries the American flag, air wing and squadron number on the fuselage in Black, as is the tail code (NG) on the tail rotor pylon. All other markings are in Medium Gray. (Sikorsky)



The SH-60F Ocean Hawk (CV Helo) ■ the Navy's new inner-zone anti-submarine warfare helicopter, replacing the SH-3 Sea King. This Ocean Hawk ■ lowering its Bendix active dipping sonar to begin a sonar sweep of the surrounding area. (Sikorsky)



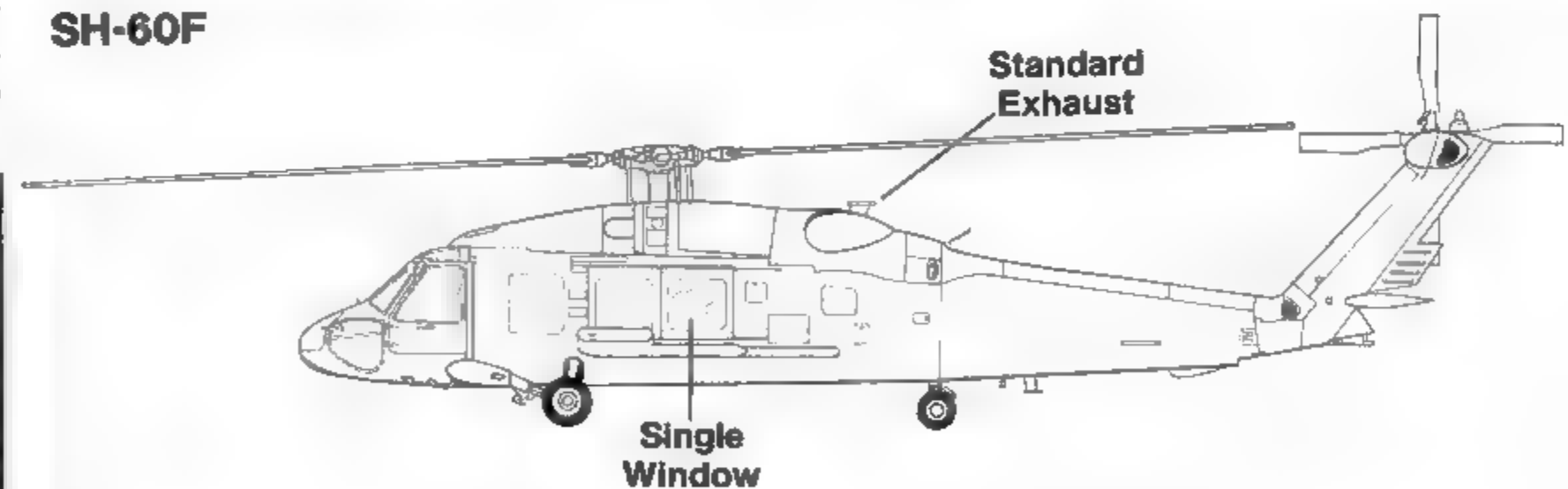
Since special warfare support missions involve flying in high threat environments, the HH-60H has been equipped with an infrared jamming system, chaff/flare dispensers, radar warning receivers and the HIRSS exhaust. (Sikorsky)

The SH-60F Ocean Hawk differs from the SH-60B in that it replaces the sonobouy/MAD gear combination with an active dipping sonar. Currently Ocean Hawks are armed with Mk 46 ASW torpedoes; however, these are being replaced by the Mk 50 light weight ASW torpedo in the near future. (Sikorsky)

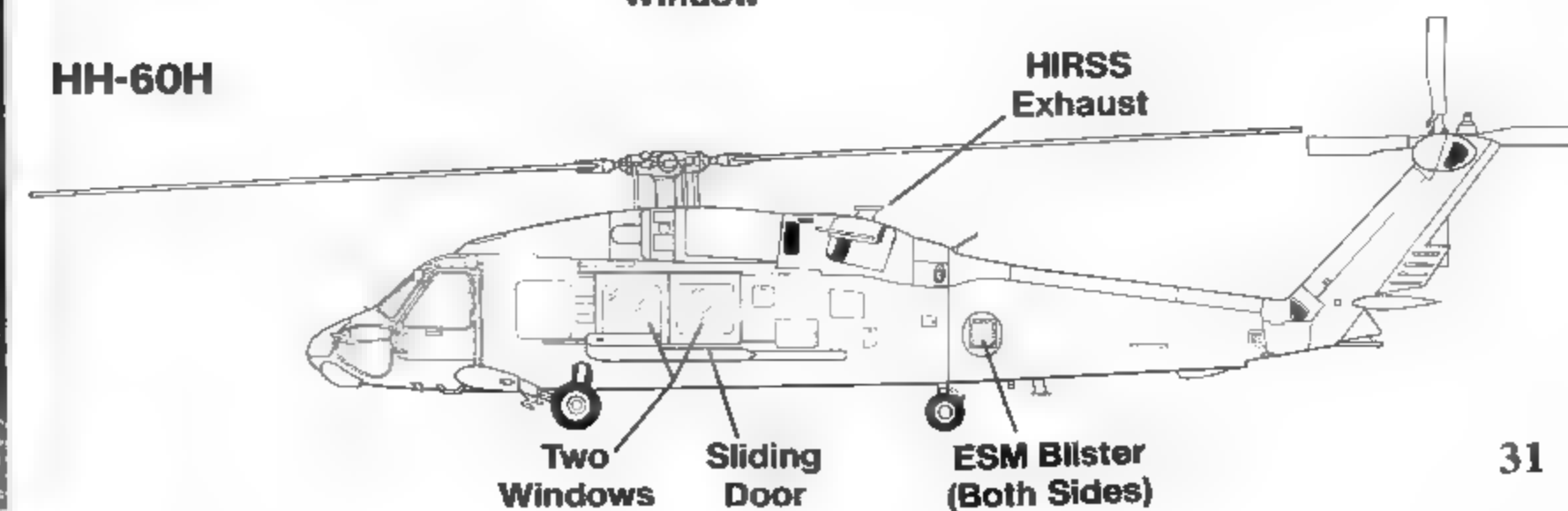


Fuselage Development

SH-60F



HH-60H





The HH-60H has significantly enhanced the Navy's special warfare support fleet. It has the necessary avionics to fly at night and under virtually all weather conditions. HH-60Hs are flown by two units, HCS-4 (Norfolk) and HCS-5 (Point Mugu). (Sikorsky)

The HH-60H uses the same T700-GE-401C General Electric turboshaft engines and power train as the SH-60F Ocean Hawk. For combat rescue missions, the HH-60H is equipped with an external rescue hoist and is armed with two M60D machine guns and external weapons on the fuselage weapons pylons. (Sikorsky)



VH-60 Presidential Hawk

The VH-60 is the only H-60 in Marine Corps service and the nine aircraft serve to supplement the Sikorsky VH-3Ds in the Presidential transport role. The aircraft are assigned to the Executive Flight Detachment of Marine Helicopter Squadron One at Quantico, VA, the first being taken into service in November of 1988.

Externally, the VH-60 resembles a UH-60A/L, although it is actually a variant of the SH-60B/F Seahawk. The SH-60B's twin T700-GE-401 turboshaft engines, gearbox and flight control systems were retained for the VH-60. The aircraft is equipped with a VIP interior including cabin soundproofing. To maintain secure world wide communications, a cabin radio operator's position is provided and all electronics are hardened against electromagnetic pulse.

The VH-60 comes with extensive avionics upgrades and is fitted with a weather radar to keep the flight crew informed of changing weather conditions. The radar is mounted in a small radome on the port side to the nose. All nine VH-60s are fitted with the HIRSS to afford the best possible protection against shoulder launched, infrared homing missiles.



Marine Helicopter Squadron One (HMX-1) VH-60s have a Gloss Dark Green fuselage with Gloss White stripes and cabin top. These aircraft are equipped with an extensive secure communication suite to insure continuous world-wide communications for the President. The VH-60 has replaced the VH-1N and compliments the VH-3 in HMX-14. (Sikorsky)

This VH-60 of Marine Helicopter Squadron One (HMX-1), is based at Quantico, Virginia. The small radome on the nose houses the antenna for the color weather radar. The logo United States of America on the fuselage is in White as is the aircraft BuNo and type block on the tail rotor pylon. (Sikorsky)



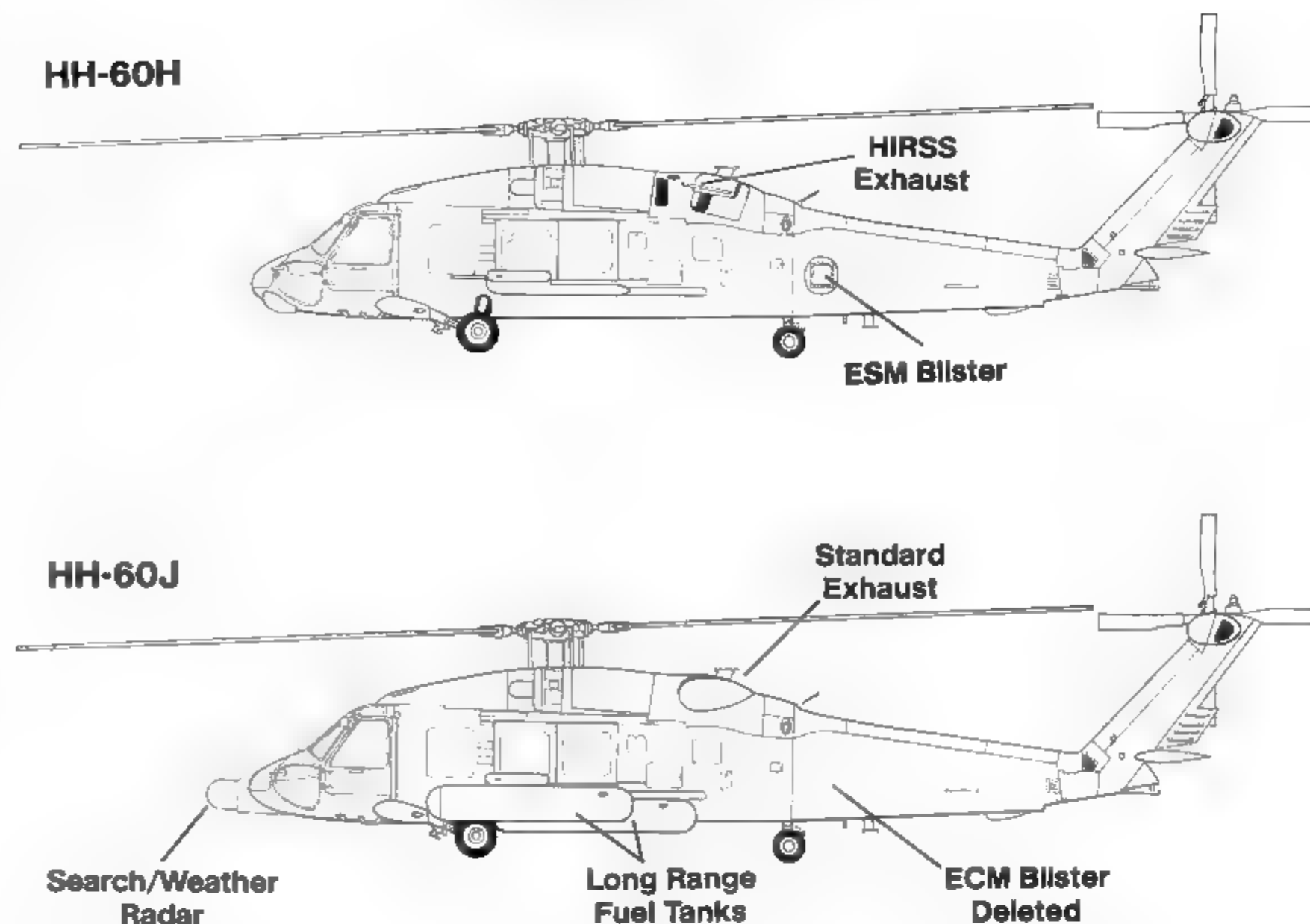
HH-60J Jayhawk Medium Range Recovery Helicopter (MRR)

In September of 1986, Sikorsky was awarded a production contract for two rescue helicopters for the U. S. Coast Guard based on the Navy HH-60H under the designation HH-60J Jayhawk. The HH-60J is basically an HH-60H with the combat survivability features deleted and a Bendix RDR-1300C search/weather radar installed in a large protruding radome on the nose. The aircraft's primary mission is medium range search and rescue, while other roles include law enforcement, drug interdiction, logistics, aids to navigation, marine environmental protection and military readiness. The first flight of a production HH-60J took place on 8 August 1989 and some thirty-five have been ordered.

The Jayhawk uses the same GE T700-GE-401C turboshaft engines used on the SH-60B/F and HH-60H. Mission requirements include the capability to fly 300 miles (carrying three 120 gallon long range tanks), loiter for forty-five minutes and return with six passengers or loiter for one hour and a half while conducting law enforcement duties. The aircraft is compatible with the helo decks on HAMILTON and BEAR Class cutters. The Coast Guard estimates that up to 250 lives may be saved annually thanks to the improved range and performance of the Jayhawk.

This Jayhawk carries a 120 gallon long range fuel tank on the starboard fuselage pylon. Two additional long range tanks can be carried on the enlarged port fuselage pylons. With three tanks the HH-60J has a range of some 300 miles. (Sikorsky)

Fuselage Development





The HH-60J Jayhawks of the U.S. Coast Guard are proven life savers, having performed a number of rescues far at sea. This Jayhawk uses its 600 pound capacity rescue/utility hoist to lift a rescue basket and passenger during a rescue training mission. (Coast Guard via Sikorsky)



HH-60Js were designed to operate in winds up to 63 knots (almost 73 mph) to allow rescues under most weather conditions. The Jayhawk has been well received by the Coast Guard, with its crews boasting that it has "power, power and more power!" (Coast Guard via Sikorsky)

This HH-60J from Elizabeth City, North Carolina patrols the coast line at low level. All Jayhawks are equipped with a nose mounted radome that houses a Bendix RDR-1300 radar. This radar is used for both weather and surface search. (Coast Guard via Sikorsky)





An HH-60J Jayhawk from the U. S. Coast Guard Air Station at Elizabeth City, North Carolina circles a freighter as it patrols the Atlantic. The long range and high speed of the Jayhawk are significant improvements over the earlier HH-3. (Coast Guard via Sikorsky)



An SH-60J Jayhawk flies low along the North Carolina coast. Besides search and rescue, the SH-60J is also used for law enforcement, marine environment protection and drug interdiction duties. (Coast Guard via Sikorsky)

This HH-60J Jayhawk (BuNo 6001) was the first Jayhawk off the Sikorsky production line and made its first flight on 8 August 1989. The high gloss Red and White color scheme of the HH-60J ensures that it can be seen for miles. (Sikorsky via Al Adcock)



Air Force Hawks

HH-60A/HH-60D Night Hawk

Both the HH-60A and HH-60D Night Hawk were intended to provide the Air Force with an all-weather combat rescue helicopter to replace the HH-3 Jolly Green Giant. Work began on the project during 1982 and ended during 1985, largely due to funding problems. The HH-60A was to have been a slightly modified UH-60A and would not have been as capable as the proposed UH-60D Night Hawk (one prototype was completed prior to the program being cancelled).

With the cancellation of the HH-60D program, the Air Force converted ten of the eleven (one having been lost in a crash) UH-60A Black Hawks that had been used for transition training to the MH-60G Pave Hawk configuration.

HH-60G/MH-60G Pave Hawk

The MH-60G Pave Hawk began to take form during 1986 when Sikorsky Support Services, Inc. was contracted to convert a number of UH-60A airframes for the combat rescue mission under the designation HH/MH-60G Pave Hawk. The modifications

initially included: the addition of an inflight refueling probe, installation of a 117 gallon internal fuel tank, fuel management panel and a folding stabilator.

Other Pave Hawk upgrades were performed in stages. The program calls for the installation of a color weather/mapping radar, Doppler, INS, SATCOM/Secure Comm radio systems and two Robinson 185 gallon internal fuel tanks. Other modifications include upgraded navigation systems with a GPS integrated with the Doppler and INS, plus a fully integrated FLIR. Combat survivability equipment includes an APR-39 radar warning receiver, Sanders ALG-144 IR Jammer, chaff/flare dispensers, .50 caliber machine guns, M134 Miniguns and HIRSS.

On 1 January 1992, the Air Force split the Pave Hawk into two different designations, the HH-60G and the MH-60G. The HH-60G is identical to the MH-60G except for the FLIR turret, .50 caliber machine gun door mounts and ESSS. Since both Pave Hawk variants are converted Army UH-60A and UH-60Ls, the power plant will vary depending on the variant being converted (1,543 shp for UH-60A conversions and 1,857 shp for UH-60L conversions).

The primary missions for the MH-60G are infiltration, exfiltration and resupply of Special Operations Forces (SOF) under most weather conditions and at night. The primary mission of the HH-60G is combat search and rescue (also a secondary mission

The HH-60D was intended to be an all weather replacement for the Air Force's HH-3 Jolly Green Giant combat rescue helicopter. Although a prototype was produced and successfully tested, funding for the project was cancelled during 1985. (Sikorsky)



for the MH-60G). The Air Force is also considering use of the MH-60G as a long range, armed escort for other special operations aircraft.

Armament configurations vary according to the mission, but can include: two modified M134 Miniguns mounted in the forward cabin windows and two .50 caliber GAU-18 multi-barrelled machines guns mounted in the cabin doors. In the armed escort role, the MH-60G Pave Hawk can carry two, nineteen shot 2.75 inch FFAR pods and two, GPU-2/A 20MM cannon pods mounted on the ESSS. The cabin window mounted Miniguns are also locked in a forward firing position for this role. The ESSS used on the Pave Hawk is the same down-swept style used on the UH-60A and UH-60L Black Hawk.

The MH-60G has a crew of four: two pilots, a flight engineer and a gunner. It can carry up to ten troops and their equipment in the main cabin. The Air Force has procured ninety-eight Pave Hawks with another five funded in 1992. Configurations of these aircraft varies widely since modification to the full Pave Hawk standard has been completed on only a small portion of the fleet. Sixteen of the current ninety-eight Pave Hawks are in the MH-60G configuration with the balance in the HH-60G configurations.



Most Pave Hawks have two 185 gallon fuel tanks installed against the rear cargo cabin bulkhead. Mounted just to the left of the fuel tanks is an internal hoist for rescue and recovery operations. (Paul Pickett)

The HH-60G Pave Hawk is identical to the MH-60G except for the deletion of the .50 caliber door guns and ESSS stub wing. Also HH-60s will not receive the FLIR turret. The primary mission of the HH-60G is combat search and rescue. (Sikorsky)

These two MH-60G Pave Hawks were painted in a desert camouflage scheme of Sand and Brown for deployment to Saudi Arabia during 1991. Pave Hawks are armed with 7.62MM M134 Miniguns in the window positions and can also carry .50 caliber machine gun mounts in the cargo doors. (Air Force)





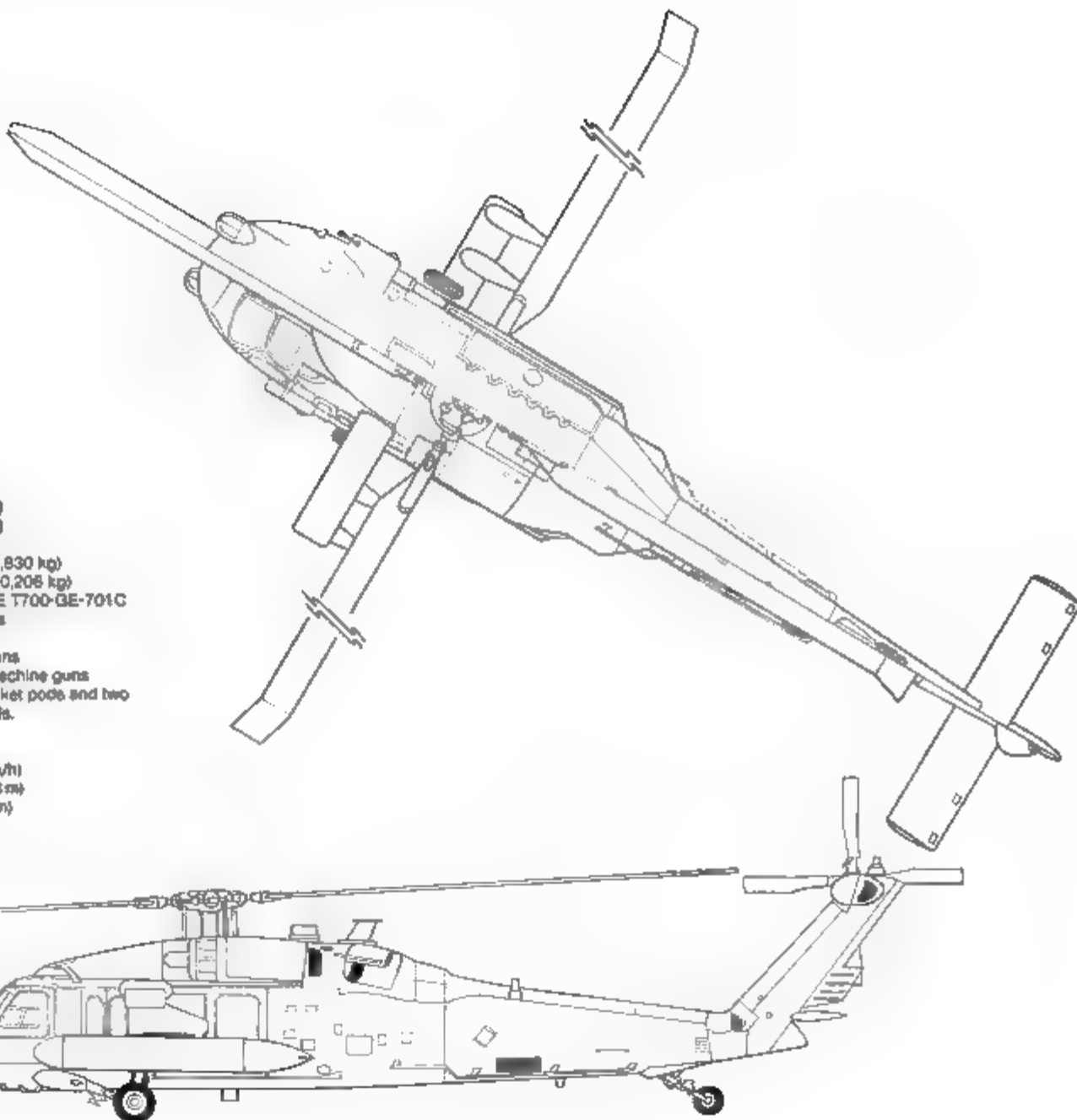
Specifications

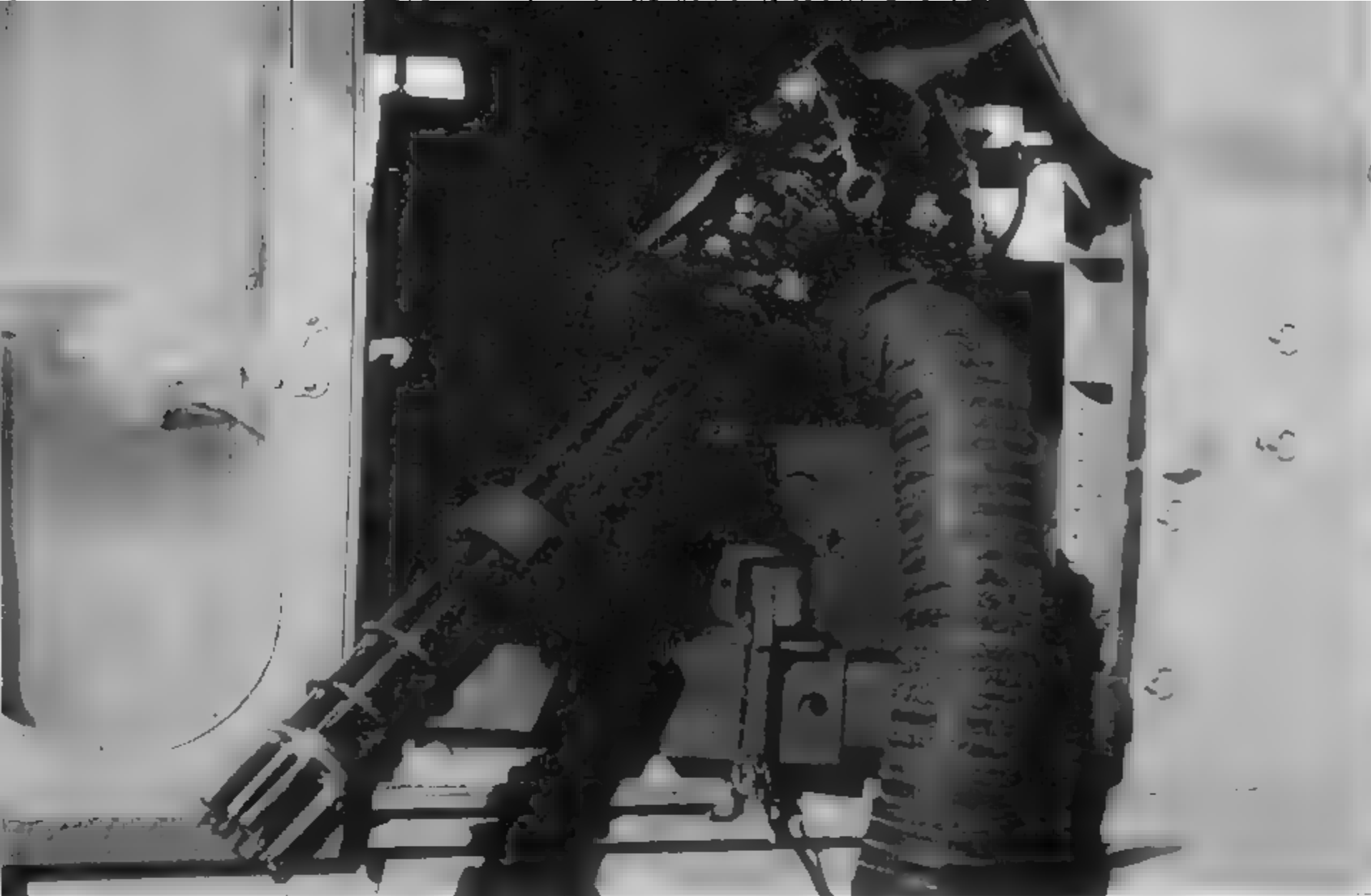
MH-60G Pave Hawk

Rotor Span.....53.7 feet (16.36m)
 Length.....64.8 feet (19.75m)
 Height.....18.8 feet (5.13m)
 Empty Weight.....10,824 pounds (4,830 kg)
 Maximum Weight.....22,500 pounds (10,205 kg)
 Power Plants.....Two 1,857 shp GE T700-GE-701C
 turboshaft engines

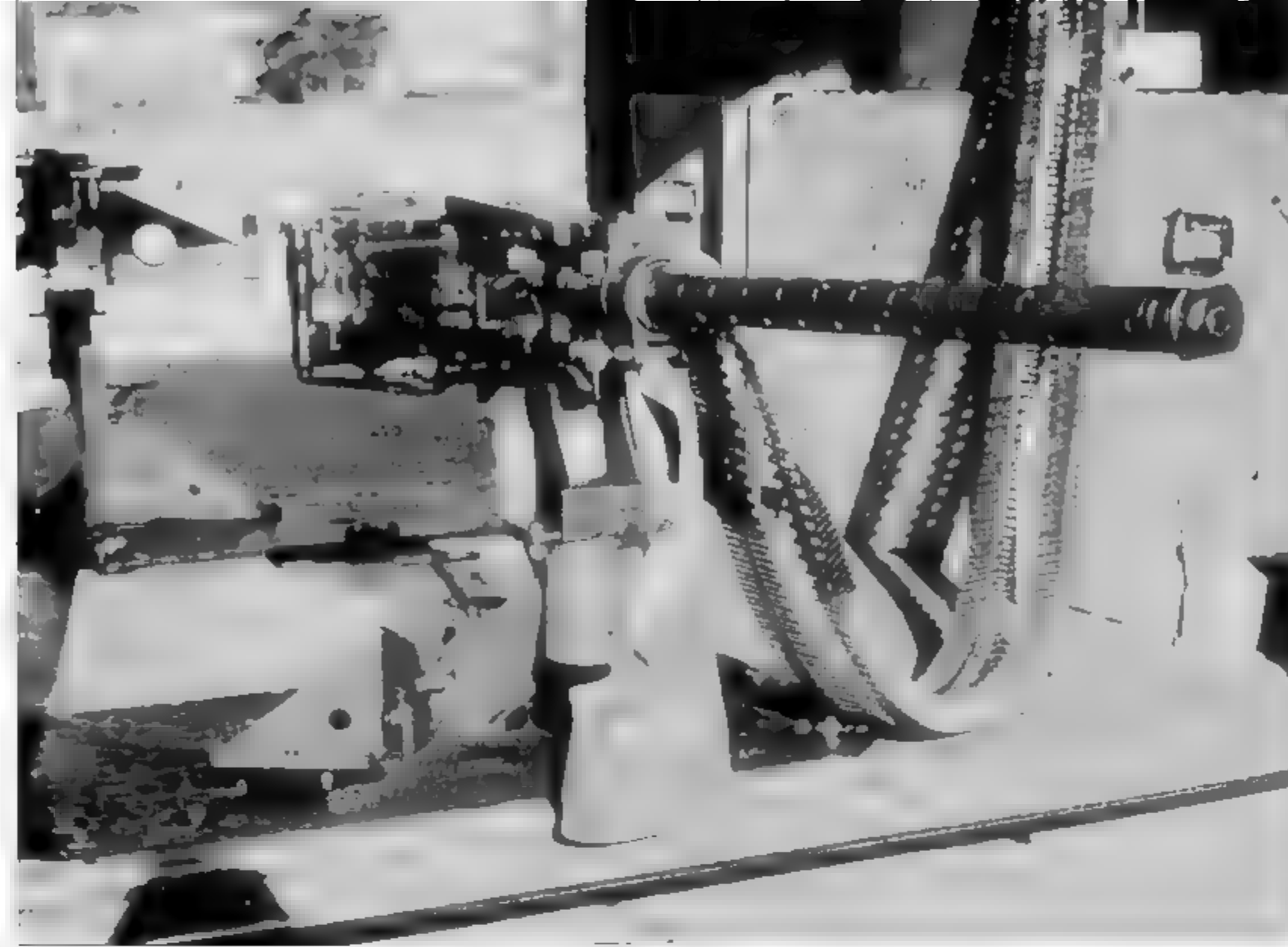
Armament.....Two M134 Miniguns
 Two .50 caliber machine guns
 Two 2.75 inch rocket pods and two
 20MM cannon pods.

Performance
 Maximum Speed.....182 mph (293 km/h)
 Service ceiling.....15,000 feet (5,791m)
 Range.....504 miles (811 km)
 Crew.....Four





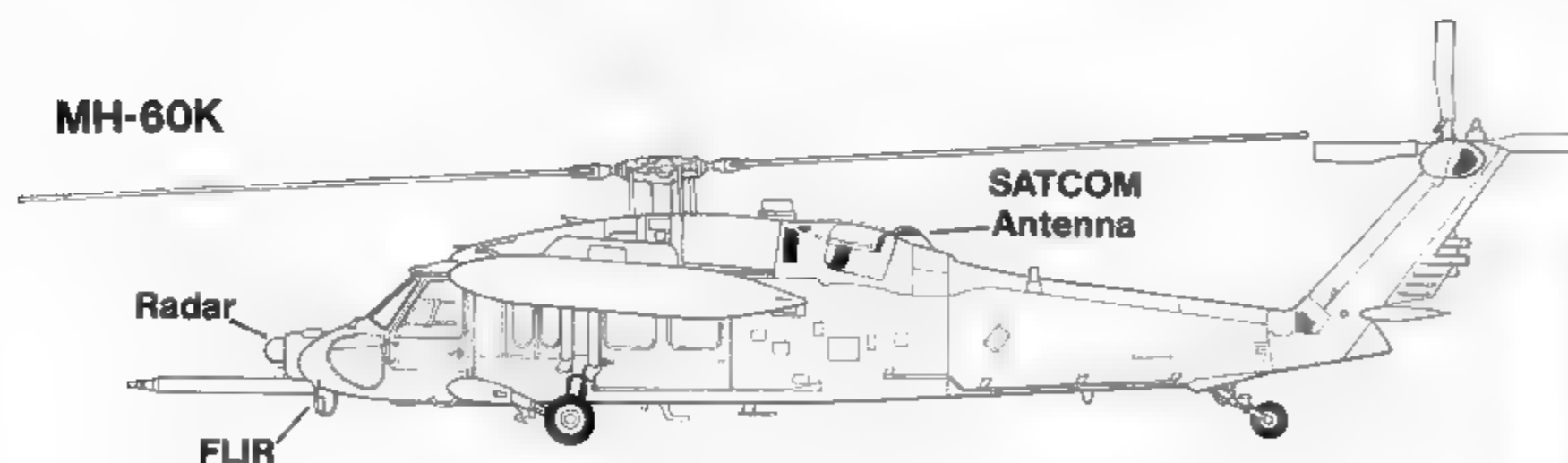
Both the HH-60G and MH-60G Pave Hawk carry two GAU-2B 7.62mm Miniguns, one in each cabin window. The GAU-2B is very reliable and fires at the rate of 2,000 or 4,000 rounds per minute. The MH-60 carries up to 7,000 rounds of ammunition for these guns. (Air Force)



Two Browning .50-caliber machine guns may be mounted in the main cabin doorway on the MH-60G Pave Hawk. Current versions of this door mount are located slightly more forward in the doorway and the guns are fitted with flash suppressors. (Air Force)

Fuselage Development

MH-60K



MH-60G/HH-60G



The MH-60G is a conversion based on the UH-60A/L airframe. The Pave Hawk program calls for aircraft to go through progressive modifications. This MH-60G has the refueling probe, and radome, but does not have the HIRSS, stub wing or FLIR. This is not unusual since many MH-60s are in different stages of modification. (Sikorsky)



Export Hawks

Sikorsky's H-60 series helicopters have found wide acceptance among international customers seeking to upgrade their rotary wing fleets. Some eighteen foreign governments either operate or have ordered H-60s (usually under their Sikorsky company designation of S-70). Most of these helicopters were purchased through direct sales, but Sikorsky also has delivered H-60s through Foreign Military Sales (FMS) contracts, and has also entered into coproduction and license production agreements.

Australia has the largest fleet of Black Hawks operating thirty-nine aircraft under the designation S-70A-9. These Black Hawks were delivered to the Royal Australian Air Force and assembled in Australia by Hawker de Havilland. These aircraft have subsequently been reassigned to the Australian Army (although they continue to be maintained by the RAAF). The Royal Australian Navy has sixteen S-70B-2 Seahawk based on the SH-60B airframe. The RAN Seahawks performed well during the Persian Gulf War, despite being deployed a year ahead of schedule.

The People's Republic of China purchased twenty-four S-70C-2 Black Hawks in the mid-1980s. Saudi Arabia has acquired twenty-one S-70A aircraft known as Desert Hawks through Army FMS contracts. Eight of these aircraft are specially equipped for the medical evacuation role. Twelve were delivered to King Khaled Military City during January-April of 1990. Mitsubishi Heavy Industries has procured a license to produce both the UH-60J for Japan's Air Self-Defense Force and the SH-60J for the Japanese Navy. Sikorsky also has a license agreement with Korean Air for production of eighty-one UH-60Ps (UH-60L) for the Korean Army. The Republic of China (Taiwan) Air Force employs fourteen S-70C-1 aircraft in the search and rescue role and Taiwan's Navy has begun taking deliveries of ten S-70C Seahawks.

Turkey has purchased twelve S-70A-17 Black Hawks, half of them standard aircraft assigned to the *Jandarma* and the remainder operated by the Turkish *Polis* (National Police). During 1988-89, Colombia obtained ten S-70As primarily for use in anti-narcotics missions. Spain has six S-70A-3 Seahawks assigned to its aircraft carrier, while Greece has ordered five S-70B-6 aircraft for its fleet. The remaining international operators of the Sikorsky S-70/H-60 helicopters include Bahrain, Brunei, Egypt, Jordan, The Philippines, Mexico, Morocco and Hong Kong. Many of these aircraft are in VIP configurations serving as transportation for government officials. In the United Kingdom, Westland Helicopters is licensed to produce the Black Hawk under the designation WS-70.

On 22 March 1992, Sikorsky unveiled a full-scale mock-up of the S-92. Sikorsky intends to market this aircraft to commercial operators for use to include offshore oil support, commuter and cargo operations and emergency medical service. The aircraft will incorporate many of the proven systems and technology of the Black Hawk/Seahawk series. Sikorsky has also proposed a military version to serve as a possible replacement of the CH-46 in the amphibious assault and vertical replenishment roles. Twenty-two troops may be carried in the amphibious assault role, plus a crew of three. The military S-92 would also be equipped with an in-flight fueling probe, chin mounted FLIR and a rear cargo ramp. The future of the S-92 will depend on the response from possible customers.



This S-70A-17 of the Turkish *Jandarma* demonstrates that the Black Hawk is quite capable of exceeding the maximum 60 degrees of bank allowed in the U.S. Army's flight manual. Turkey has ordered a total of twelve aircraft which are split between several organizations. (Sikorsky)



This UH-60J was used to conduct factory flight testing during late 1990 at Sikorsky's Stratford, CT facility. The UH-60J is built under license in Japan by Mitsubishi Heavy Industries for the Japanese Air Self Defense Forces. (Sikorsky)



A pair of Japanese Maritime Self-Defense Force UH-60J search and rescue helicopters on patrol near the Japanese coast. Both the JMSDF and Japanese Air Self-Defense Force fly the UH-60J. (JGSDF via Lennart Lundh)

This SH-60J Seahawk of the Japanese Maritime Self-Defense Force is equipped with Japanese electronics and equipment. The JMSDF has a requirement for some 100 SH-60Js to replace the HSS-2 Sea Kings currently in service. (JGSDF via Lennart Lundh)





This S-70A-1 was one of twenty-one Desert Hawks delivered to the Royal Saudi Land Forces Army Aviation Command. Eight of the Sand and Brown camouflaged Saudi S-70A-1s are S-70A-1L medical evacuation variants which can carry six litters. (Sikorsky)

Australia has the largest fleet of all foreign operators of the H-60/S-70 series. The top aircraft is an S-70B-2 Seahawk in service with the Royal Australian Navy while below it is an S-70A-9 of the Royal Australian Air Force. All S-70A-9s have since been reassigned to the Australian Army. (Sikorsky)

The People's Republic of China has received twenty-four S-70C-2 utility helicopters. This S-70C-2, landing at Lhasa, Tibet, will be used for utility and rescue missions in high altitude areas such as the Himalayan Mountains in the background. (Sikorsky)





This UH-60P of the Republic of Korea Army (ROKA) is the same as the UH-60L Black Hawk used by the U.S. Army, except for those items of equipment and avionics specified by the ROKA. The aircraft are co-produced by Sikorsky and Korean Air in Korea. (Sikorsky)



Sikorsky introduced the full-scale mock-up of the S-92 on 22 March 1992. Its Black Hawk lineage is evident around the rotor head, engine intakes and tail rotor pylon. This commercial version would have a capacity for nineteen passengers. (Sikorsky)

This S-70A of the Government of Bahrain was specially modified for the VIP role for use as an executive transport. The aircraft was delivered under a Foreign Military Sales (FMS) contract and is equipped to UH-60L standards. (Sikorsky)



Sikorsky has also produced a full-scale mock-up of a military version of the S-92. This version is being offered as a possible replacement for the ageing Marine Corps H-46 fleet in the amphibious assault and vertical replenishment roles. (Sikorsky)



Combat

In October of 1983, the UH-60A Black Hawk received its baptism of fire during Operation URGENT FURY in Grenada. The Black Hawk performed "as advertised" with a high degree of reliability, maintainability and survivability. One aircraft took over forty-seven hits through drive shafts, primary servos, hydraulic pumps, the cockpit and other areas and still returned to base. The self-sealing fuel tanks proved a success when one aircraft took five rounds through a fuel cell and no leaks occurred until a couple of days later.

One problem did become evident during air assaults into "hot" Landing Zones (LZs). Casualties were being taken from small arms fire penetrating the bottom of the cargo cabin. A post action Army review of this problem resulted in a blanket of Kevlar that was custom fitted and secured to the cargo deck to provide protection from up to 7.62MM projectiles. These deck blankets were to see widespread use during Operation DESERT STORM.

Operation JUST CAUSE, conducted in December of 1989, would see not only the combat use of UH-60As, but also Air Force MH-60G Pave Hawks as well. MH-60G Pave Hawks were deployed to Panama from the 55th Special Operations Squadron, Eglin AFB, Florida. During the first night of this operation, a Navy SEAL team was dropped at Patilla Airfield in Panama, the site where Panamanian strong man Manuel Noriega kept his personal aircraft. The SEAL team's objective was to take and hold this facility to prevent Noriega from leaving the country.

As soon as the SEAL team hit the ground, they started taking heavy fire and casualties. Facing far stronger resistance than expected, the SEAL team radioed for reinforcements and extraction of their casualties. Due west of Patilla, at Howard Air Force Base, an MH-60G Pave Hawk and a MH-53J Pave Low were on strip alert for just such an emergency.

Once both aircraft had been readied for loading casualties, they took on SEAL reinforcements and flew low level under cover of darkness to Patilla. The Pave Hawk flew using NVGs (night vision goggles) while the Pave Low used the chin mounted FLIR for navigation. According to MAJ Gene Winterrowd and CAPT Ray Pope of the 55th SOS, flying low level over jungle and water at night with an overcast and no moon required 100% of their attention. CAPT Pope added that flying this kind of NVG mission was "only slightly less nerve racking than getting shot at!"

Halfway en route to Patilla, contact was lost with the SEAL team on the ground. Loss of radio contact caused difficulties determining where the SEAL team was and raised concern that the team might fire on them in the confusion of the battle (there were reports of enemy aircraft in the air on that first night). While the MH-53J went into a circular orbit over the battle, the Pave Hawk's crew was able to locate the SEAL team using their NVGs. The Pave Hawk then landed in the middle of the team, while a firefight was in progress. After discharging their reinforcements and loading casualties, the Pave Hawk took up an orbit over the battle so that the Pave Low could go in. The Panamanian Defense Forces could hear the aircraft but could not see them in the total darkness. The SEAL reinforcements turned the tide of this battle and Patilla was secured.

Since operational flights began in July of 1991, the Coast Guard's Jayhawk has proven itself an "angel of mercy." In October of 1991, the Jayhawk received national recognition for its daring rescue of the crew of the schooner ANNE KRISTINE. Two Jayhawks were dispatched from the U. S. Coast Guard Station at Elizabeth City, NC after the 106 year old schooner was battered by Hurricane Grace. Despite strong winds and heavy seas,

"Bart Man" goes to war dangling from the center windscreen of this UH-60A Black Hawk. The netting behind the pilot was installed to prevent gear and equipment carried by the assault troops from getting into the cockpit. The crew chief has deployed the port M60 machine gun. (Bryan Creel)

UH-60As of the 82nd Airborne are prepared for deployment to Saudi Arabia during August of 1990 for participation in Operation DESERT SHIELD. The aircraft were transported via USAF C-141 and C-5 transports and were based at Dhahran. (USAF via Dick Cole)



one of the HH-60Js rescued all nine survivors. The following day, another Jayhawk was dispatched from Elizabeth City to rescue the crew of the pleasure boat, SNOWY EGRET. This boat was floundering approximately 300 miles off the coast. After an overnight stay on the carrier USS AMERICA, all four survivors were safely returned home.

Operation DESERT SHIELD and DESERT STORM

The H-60 saw widespread use during the Persian Gulf War with the U. S. Army alone deploying approximately 400 Black Hawks to Saudi Arabia. The ground war began on 24 February 1991, with the largest single lift in air assault history with more than 300 aircraft participated in the operation. Company C, 5th Battalion, 101st Aviation Regiment, 101st Airborne Division served as the Division's lead assault element into LZ Cobra on the opening day of the war. At the request of the infantry, the assault began shortly after first light to avoid the confusion and navigation problems that a night landing would have caused.

Company C's UH-60As carried fifteen fully equipped combat troops, extra weapons, rations, water and other equipment deep into the Iraqi desert. The troop seats had been removed from the Black Hawks so that the infantry could carry extra gear and egress the aircraft quickly. These Black Hawks were escorted by AH-64A Apache gunships as they flew at only ten to twenty feet above the barren desert enroute to the landing zone. As soon as the Black Hawks had touched down at LZ Cobra, the infantry exited out each

THE INFIDEL, flown by CW2 Dana Ravenberg and WO1 Mike Oldfield, was heavily damaged in a crash landing during Operation DESERT STORM. No serious injuries occurred as a result of this accident (apparently cause by a loss of tail rotor effectiveness) and the crew finished Operation DESERT STORM flying **THE INFIDEL II**. (Mike Oldfield via Dana Ravenberg)

side of the aircraft and stayed low to provide clear fields of fire for the door gunners. After the UH-60s took off, the infantry began to take fire from a large bunker complex they had just overflowed. After offering light resistance, over 350 Iraqi prisoners were taken and LZ Cobra secured.

Although this unit did not lose any aircraft to enemy fire, two were damaged while in Iraq due to different causes. The 2nd Battalion, 229th Aviation Regiment lost one of its Black Hawks to enemy fire during a rescue attempt for a downed F-16 pilot. As the Black Hawk approached the pilot's position, they began receiving heavy anti-aircraft fire which brought down the Black Hawk and damaged an AH-64A Apache that was serving as escort. Sadly, only three were to survive the crash: the flight surgeon (MAJ Rhonda L. Cornum), the crew chief (SSGT Daniel J. Stamaris Jr.) and a pathfinder (SPC Troy A. Dunlap). All three, along with the F-16 pilot (CAPT William F. Andrews), were captured by Iraqi forces.

SH-60B Seahawks were also used extensively during the Gulf War. Their surface search radar enabled the Seahawks to provide the Task Group commander with over-the-horizon search and targeting information. In the ASST (Anti-Ship Surveillance Targeting) mission, the Seahawk Lamps Mk III, working in combination with a TASM (Tomahawk Anti-Ship Missile) ship, makes a formidable weapon against enemy ships. The standard armament of the SH-60B consists of Mk 46 torpedoes (the Penguin anti-ship missile is planned for the near future).

Seahawks serving in the Gulf were modified with the Enhanced Survivability Package (ESP) which consisted of an ALQ-144 IR jammer, ALE-39 chaff/flare dispensers as well as a missile detection package for automatic deployment of chaff and flares. Radar

This UH-60A of the 2nd Battalion, 17th Cavalry demonstrated the crashworthiness of the Black Hawk during Operation DESERT SHIELD. Everyone on board survived this crash into a sand dune. Reportedly, the aircraft was flying at about 100 knots when it hit! (Stan Stacey)



warning and identification information obtained by the Seahawk was processed on the ship from the raw information received via the Seahawk's data link. Seahawks also carried the AIRBAC system during the Gulf War to provide the Task Group with maximum protection against the Chinese made Silkworm ship and shore based anti-ship missiles. The AIRBAC was a large chaff round (much larger than the standard chaff round carried in the ALE-39) that could be launched from one of the SH-60B's twenty-five sonobuoy tubes.

During the Gulf War, a total of six UH/SH-60s were lost to all causes. Of these only two were combat losses. The H-60 family has proven itself to be a workhorse capable of completing every mission it was designed to accomplish and quite a few outside its design. This impressive family of Sikorsky helicopters will continue to serve proudly in all branches of the U. S. Armed Forces for many years to come.

This Forward Arming and Refueling Position (FARP) was located just inside Saudi Arabia on the Iraqi Border. These Black Hawks are "hot refueling," that is, taking fuel with their engines running and rotors turning to allow for a quicker turn-around for the next mission. (Dan Cole)



A Royal Saudi Land Forces S-70A-1 Desert Hawk kicks up a cloud of sand as it comes in for a landing. Thirteen Desert Hawks were airlifted to Saudi Arabia between January and April of 1990. The U.S. Army transferred another eight UH-60As to the Saudis during DESERT STORM. (USAF via Dick Cole)



This weathered UH-60A parked on the sand in Saudi Arabia shows the effect of 125 degree heat and blowing sand. The aircraft is equipped with an ESSS and chaff/flare dispensers. Maintenance personnel did an excellent job keeping the Black Hawks mission ready. (Bryan Creel)

Troops of the 101st Airborne Division load aboard a UH-60 for an air assault mission into Iraq. The UH-60's crew has hung an American flag on the rear cargo cabin bulkhead. The trooper in the foreground is dressed in a desert camouflage uniform, but has a European camouflage flak vest. (Mike Oldfield via Dana Ravenberg)

This UH-60A takes on troops in the green rice fields of the Euphrates Valley in Iraq. The UH-60 Black Hawk was the most numerous helicopter deployed to Saudi Arabia and proved itself to be a tough and durable machine during Operation DESERT STORM. (Bob Hess)





A number of UH-60s returned from the Gulf in an overall Sand desert camouflage scheme, like this badly weathered UH-60. Additionally, the aircraft carried a scoreboard in Black between the crew chief cabin windows and the pilot's door. (Werner Roth)



The Black scoreboard on this Sand camouflaged UH-60 Black Hawk indicated that at least seventy-two Iraqi Army prisoners-of-war (POWs) were transported in the Black Hawk to internment camps in Saudi Arabia. (Werner Roth)

Aircrews of Company C, 5th Battalion, 101st Aviation Regiment, 101st Airborne Division (Air Assault), proudly gather at Landing Zone Cobra, Iraq with "Old Glory" and their UH-60 Black Hawks. This unit is typical of the pride, professionalism, and dedication of the volunteer military. Thankfully, they all came home — let's not forget those that did not. (Bryan Creel)





An SH-60B Seahawk of Light Anti-submarine Helicopter Squadron 43 (HSL-43) aboard USS CONSTELLATION (CV-64) drops an ASW torpedo during a live fire exercise.

The USAF uses the MH-60G Pave Hawk as a special operations and combat rescue aircraft. This MH-60G serves with the 55th SOS at Eglin AFB, Florida.

